MODEL AIRPLANE NEWS

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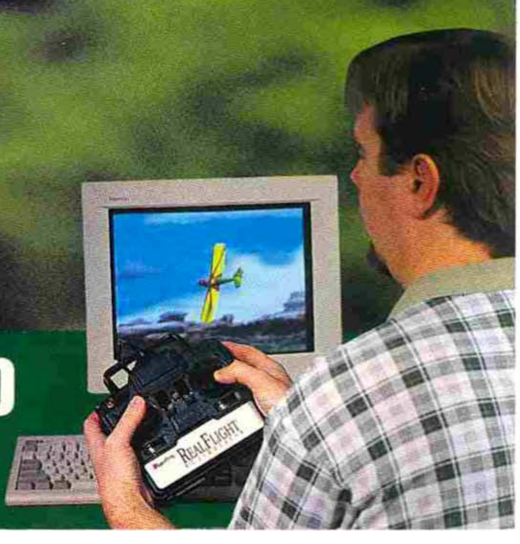

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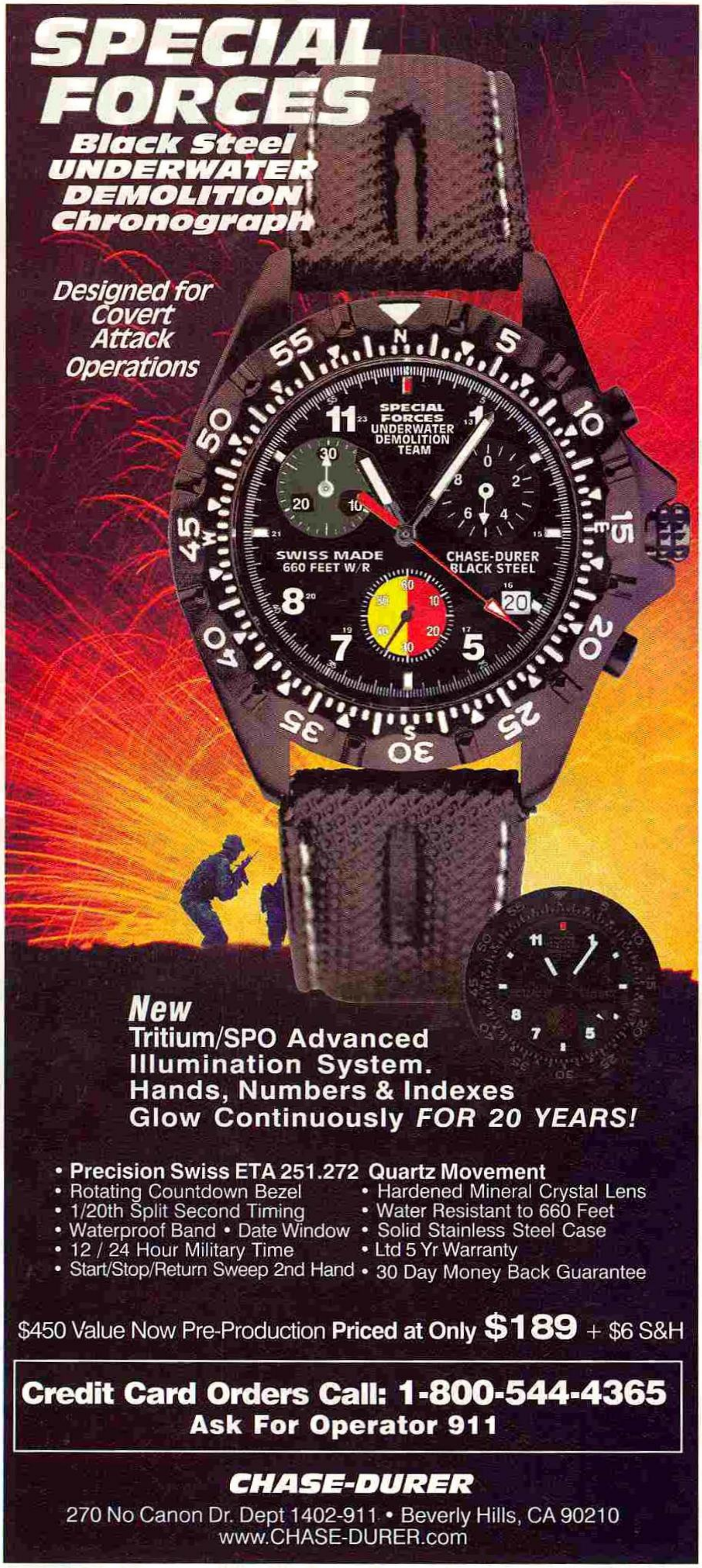
with RealFlight



MODEL AIRPLANE NEWS

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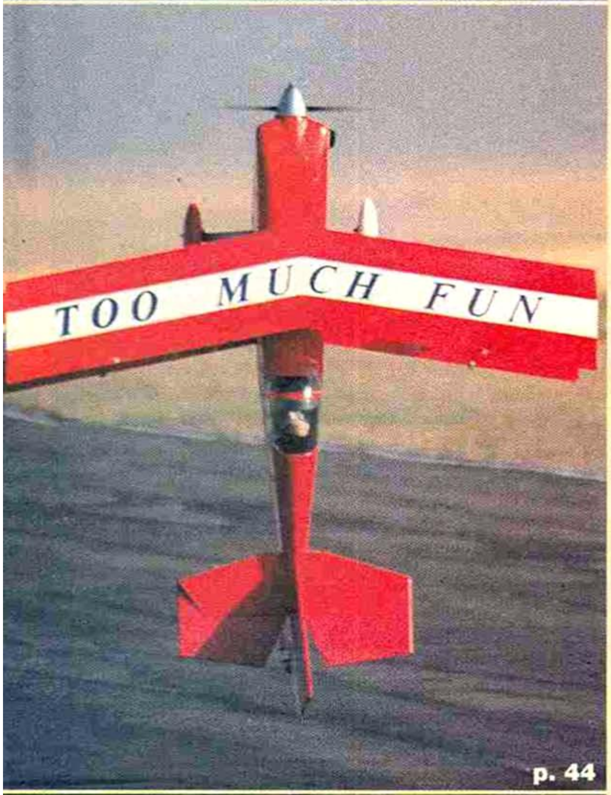

ON THE COVER: a Fokker Dr.I does a low flyby at the Joe Nall Memorial Giant-Scale Fly In (photo by Gerry Yarrish). Inset: RealFlight brings a new level of realism to R/C flight simulators.

ON THIS PAGE (top to bottom): build the American Eagle Bearcat to fly at your local warbird meet; interest in IMAC is growing, mostly because it's so much fun; a couple of Texans taxi out for takeoff at Joe Nall.

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EDITORIAL

by LARRY MARSHALL

GRASSROOTS

If you stand back and look at our hobby, one of the things that stands out is the diversity of ways in which people enjoy it. This cuts across many lines. Some people like to build model airplanes, flying rarely, if at all. Others are avid flyers, building only when necessary and then only as a means to an end. In the middle of this dichotomy, however, are the majority: those who seem to like both building and flying.

Some people like to compete, while others claim not to compete; but if you watch them at their flying field, they're constantly competing with their peers—mine's bigger, mine's prettier, mine's faster, "I can fly better than you"—that sort of thing. In fact, there are a lot of these closet competitors in our hobby.

Other people like to fly in an organized fashion but don't like to compete. These are the folks who fill the ranks of IMAA meets and other rallies that are so popular around the country. Some flyers never fly anywhere but at their home field; they feel uncomfortable flying in front of crowds or with strangers.

It's also the case that model preferences vary a lot. Some folks like to fly control-line, be it stunt, scale, speed, or combat. Others prefer to fly free flight, with scale being very popular, though, so are the "old-time" free-flight planes. But others prefer heart-stopping climbs from gas-engine free-flight planes that flop out into a peaceful glide; the trimming challenges with this extreme flight envelope can at times even baffle the experienced.

This array of IMAC-legal aircraft demonstrates why IMAC is becoming so popular.

R/C model preferences seem to run the entire gamut of possibilities. Right now, scale is very popular, but sport planes are still flown by many people. Pylon racing, unlimited racing, IMAC aerobatics, pattern, helicopters, etc.—all have their advocates. And, of course, there are nuts like me who try to do it all. In addition to these model choices are power-system choices, with guys using rubber, CO_2, glow, gas, electric and even compressed air to power model aircraft.

This variety lets people choose their niche(s), have fun and hang out with others who have like interests. For a magazine to try and cover it all, however, is quite a challenge. We have limited space and limited resources, but we do the best we can to provide as much diversity as possible. To accomplish this, we rely on articles submitted by our readers.

When it comes to coverage of events, however, we've got a dilemma. To cover a model aviation event in the way we at *Model Airplane News* typically do requires excellent photography, good text, investigative reporting during the event and a lot of pages. There are several things that come from this. For the most part, we, the staff of *Model Airplane News*, cover most of the events, which limits the number that we can do (we can only be so many places at the same time); the need for pages means we can't run very many coverages during the year.

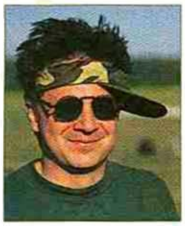
But we think model aviation is too diverse and too interesting to maintain that status quo. We need your help to cover those events that we are unable to attend. We feel we will be able to solve many of the problems I've outlined by doing event reporting that is different from our typical coverage. So, we're implementing a new feature in our magazine that will present single-page coverage, provided by you—the readers of the magazine. We won't be able to publish all articles submitted to us, and we won't be able to return photos.

To consider your article for publication, we'll need some good, crisp color photos—preferably in slide form—300 to 400 words describing the event and, if it's a competition, a table with information about the winners. We're especially interested in events that show some imagination and that can provide others with ideas about how to have fun in model aviation. Send your event coverage to us at *Model Airplane News*, Grassroots Events, 100 East Ridge, Ridgefield, CT 06877-4606.

JOE NALL AND IMAC

One of the ways that people are having fun these days is by building and flying IMAC models. IMAC brings scale and aerobatics together in a very interesting way, by having model pilots fly the maneuvers flown by full-scale aerobatics pilots. These sequences are determined by the International Aerobatics Club every year. Since virtually any scale aerobatic aircraft (Extras, Lasers, CAPs) is eligible for IMAC competition, it is quickly growing in popularity.

Joe Nall was a friend of Pat Hartness who died tragically in a plane crash. Pat has dedicated his superb IMAA meet to his friend, and the quality of the meet speaks volumes about the quality of the men who inspire and manage it. It's one of the larger fly-ins in the country, and Pat puts on an incredible show, making pilots and spectators alike feel at home. Gerry Yarrish brought back some great shots of the action, and he will tell you about this great event.



Air SCOOP

by CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

1/12 SCALE

Air Kill Hawker Sea Fury FB11

Highly regarded for their top-quality 1/12-scale warbird kits, Air Kill now introduces this Hawker Sea Fury FB11, which joins the P-47D in the company's developing 1/9-scale line. Made following the same "careful attention to detail" philosophy as Air Kill's 1/12-scale kits, this larger Sea Fury is designed for .40-size engines and boasts excellent sport/scale flight characteristics, great slow-speed stability and all-around in-the-groove performance.

All the wooden parts were designed with CAD accuracy and cut with laser precision. The kit includes: high-quality styrene cowl; scale-outline canopy; vacuum-formed scoops; detailed plans; and complete hardware package with Sig and Du-Bro items. Specs: wingspan—49 inches; wing area—474 square inches; weight—4.5 to 6.5 pounds; engine required—.35 to .45 2-stroke, or .60 to .91 4-stroke.

Air Kill Products, 14 Shady Lake Ct., Sacramento, CA 95834; (916) 425-9933.

Cadillac of the Slopes

With Durable Aircraft Models' (DAM) new 1/7-scale P-51D Mustang slope glider, you can fly escort to the local hawks during their rodent interdiction missions. Made of dent-resistant expanded polypropylene (EPP) foam, this kit was designed for the hard landings and midair collisions of slope combat flying. According to the manufacturer, you can literally punch this plane, and the foam will rebound to its original shape. Simple assembly takes about 20 hours to complete, and the EPP surface is covered with iron-on film for a great looking semi-scale model.

Fly the Mustang in 7 to 10mph winds, or add up to 4 pounds of ballast for penetration in high-lift conditions. Electric conversion is easy, and the kit can be ordered with an optional clear canopy for $10. Specs: wingspan—65.5 inches; wing area—692 square inches; weight—70 to 74 ounces; airfoil—S3021. Watch for DAM's Me 109 and T-33/P-80 kits!

Durable Aircraft Models, 59 Matisse Cir., Aliso Viejo, CA 92656; (714) 362-9222.

Gyro Bee

You knew it had to happen sooner or later. The Clancy Lazy Bee is such a unique and popular design, it was only a matter of time before someone offered an autogyro version. Available as a deluxe conversion kit (with or without fuselage) from Autogyro Co. of Arizona, this self-contained module simply replaces the wing on a standard Clancy Lazy Bee and does not require any re-balancing or radio changes.

The kit includes a special prebent landing gear that facilitates autogyro ROG-type ground operation. It also comes with: laser-cut parts; machined-Delrin head; laser-cut airfoil-shaped rotor blades; and complete setup, construction and flying manual. A "Gyro Bee" video offers additional information on setup, blade tracking, autorotation test spins, hand-launch/ROG takeoffs and dead-stick landings.

If you don't have a Lazy Bee, a separate Clancy Aviation fuselage kit is available. At a disk loading of only 3.5 to 3.9 ounces per square foot, the Gyro Bee floats and is especially suited to small-field operation. Power requirements: .15 to .25 2-stroke, .26 to .28 4-stroke; or electric motor producing 2 pounds of static thrust.

Autogyro Co. of Arizona, 3307 West Renee Dr., Phoenix, AZ 85027.

O.S. EXCLUSIVE .91 FX

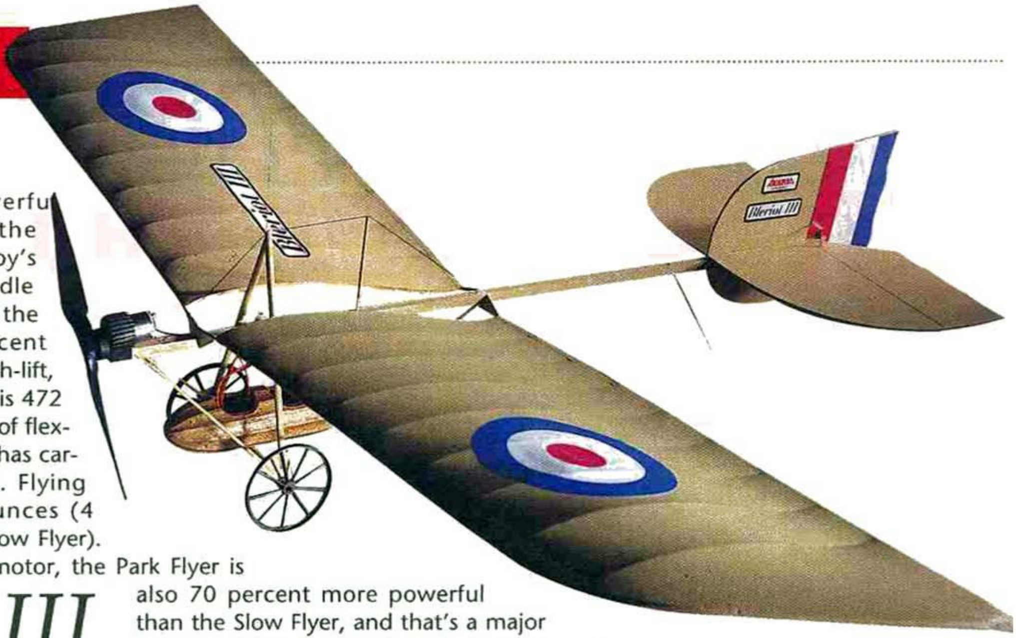
AT LAST! O.S. now offers a .91 in the FX lineup; thank you. Like the others in the line, the new .91 features: ABN technology (aluminum piston with nickel-plated brass sleeve); twin ball-bearing-supported crankshaft; and twin-needle carburetor with a designed-for-safety, rear-mounted, high-speed needle valve. My only other information is that the engine appears to have a slight "over-square" design with a 1.197-inch bore and a 1.083-inch stroke. Factory-stated practical rpm rating is 2,000 to 16,000, and weight without muffler is 19.42 ounces.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-1104; website: www.greatplanes.com.

SIMPLE & SECURE

Reid's Quality Model Products now offers an ideal solution to your fuel-filling needs. Fuel-It—a machined-aluminum cap collar made of two parts—is attached to your engine cowl through a hole and secured with a nut from inside. Simply plug the cap into the end of your filler line to seal it, then plug the whole thing (cap and tube) into a cowl-mounted collar. The plug is held securely by an O-ring. This is not only a very neat-looking filler system, but it's also highly recommended for engines with pressurized fuel systems, like the YS, because of its simple, airtight and leak-resistant seal.

Reid's Quality Model Products, 30 Clifton St., Phelps, NY 14532; (315) 548-3779.



Blériot III

PARK FLYER

Faster and more powerful than its predecessor the Slow Flyer, Hobby Lobby's new Blériot III can handle flying in a breeze. Like the Slow Flyer, it's 95-percent ready-built. Its large, high-lift, 50-inch wing (wing area is 472 square inches) is formed of flexible Novalight foam and has carbon-rod reinforcement. Flying weight is about 11 ounces (4 ounces more than the Slow Flyer). Powered by a 400-size motor, the Park Flyer is also 70 percent more powerful than the Slow Flyer, and that's a major contributor to its improved light-wind capabilities.

The airplane is extremely easy to fly and has about a 10-minute flight duration on one charge. Designed for rudder, elevator and motor controls, flying in limited areas such as small parks, ball fields and backyards is what it does best; it turns quickly, takes off promptly and is durable and repairable. Rumor has it that the Blériot III Park Flyer is also very reasonably priced.

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

IMAA ARF

Space Walker

An all-wood, MonoKote-covered, IMAA-legal, scale model that fits in an average-size car and can be built in a few evenings ...? Now, *this* is something we need more of! Great Planes' new ¼-scale SpaceWalker looks scratch-built when finished, but it's an ARF that requires only final assembly to get it to the flightline. It looks beautiful, is built straight and strong, flies like a SpaceWalker (like a dream, of course) and is aerobatic. This very lightly wing-loaded design begs to be flown confidently close in and slow. What more could I ask for? OK; maybe an O.S. Gemini twin under the cowl; then I'd be 100 percent content.

The kit includes: hand-painted ABS wheel pants and one-piece cowl; generous hardware package; heavy-duty, hand-welded landing gear; and adjustable engine mount. Specs: wingspan—79 inches; wing area—1,096 square inches; weight—8 to 8.75 pounds; wing loading—16.8 to 18.4 ounces/square foot; engine required—.61 to .75 2-stroke, or .70 to .91 4-stroke.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.

Commando Tools

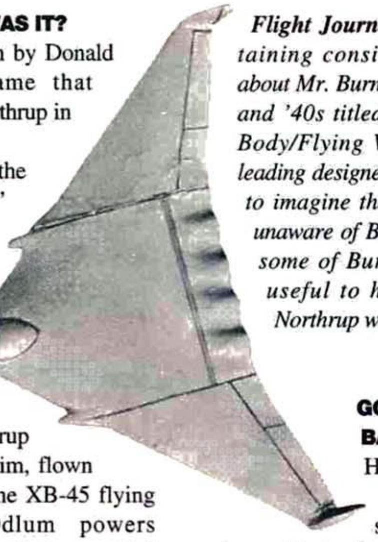
Jet Model Products' new line of high-quality hand tools—the Commando line—includes files, drills, screwdrivers and small hammers. The tools feature precision steel chucks, heat-treated alloy or hardened-steel bits and blades and non-slip finger-grip handles. Blades and drills may be stored in the handles—first-quality, compact field gear.

Jet Model Products, 211 N. Mullen Rd., Belton, MO 64012; (816) 331-0356; fax (816) 331-3930.

AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News**, 100 East Ridge, Ridgefield, CT 06877-4606; email **man@airage.com**. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

WHOSE IDEA WAS IT?



Long ago, it was written by Donald Douglas of DC-3 fame that "There's a little Jack Northrup in every plane."

I read the article on the BWB-17 "blended wing" test model, a reported concept of McDonnell Douglas, and realized that they are now espousing a concept that long, long ago was not only espoused by Jack Northrup but also developed by him, flown by him and proven in the XB-45 flying wing. Only the Odlum powers (Convair/General Dynamics)—coupled with the "beholden" USAF—served no one by causing it to become a dead program. Now to see McDonnell Douglas getting kudos for an "amazing" concept causes this old-timer to raise a flag for truth. I worked for MAC; I know how adept they were (and still may be) at basically co-opting another's design, pasting on a new buzzword name and claiming it as their own, when in truth it is not totally so. The so-called "blended wing" BWB-17 is simply a fancy version of Jack Northrup's 1940s to 1960s basic flying wing technology; nothing more.

At least Jack's B-2 may prove and regain the points lost over 50 years ago when a highly viable, better-performing wing that could run rings around the B-36 was destroyed through shady politics and power.

I know whereof I speak, having an aerodynamics degree and having been in frontline aerospace since 1948. Just check your history and patents on flying wings; you'll see.

JOHN DEDEN
Missouri City, TX

John, you make some good points; it's certainly the case that McDonnell Douglas didn't invent the flying wing and/or lifting body concept. I might take issue with your view that Jack Northrup did. I wonder if he got some of his inspiration from the Burnelli model pictured here; a design by another guy who didn't get his fair share of the accolades: Vincent Burnelli. The fall 1996 issue of **Flight Journal** *had an article containing considerable information about Mr. Burnelli's efforts in the '30s and '40s titled "Saga of the Lifting Body/Flying Wing." As one of the leading designers of the '40s, it's hard to imagine that Jack Northrup was unaware of Burnelli's work and that some of Burnelli's ideas weren't useful to him in designing the Northrup wings.* LM

GOOD PRODUCTS, BAD COMBINATION

Having returned to this great hobby after some 30 years, I was taken with the Goldberg Extra 300 and just had to build it. When I was a kid, I built elastic-powered, tissue-covered models, usually without any other finish. My Extra 300 is almost finished and is in the covering/finishing stage. But I'm having a problem with the fabric.

My local hobby shop recommended that I use heat-shrinkable Sig Koverall with a Z-Poxy finishing resin as a filler. All went well until I applied the second coat of the finishing resin. The Koverall was perfectly stretched, and the first coat of resin had no adverse effect. The second coat of resin finished somewhat unevenly, though I did remove as much excess as I could. However, when I began to sand off the rough spots, I found that the fabric became loose wherever I sanded. This condition seems to vary according to the temperature in my shop. I believe that with the application of resin, the fabric should stabilize. I have not applied a second coat to the open areas of the wings as yet, and I hesitate to do so. As I have put a lot of effort—plus a lot of goodies—into this airplane, I would like to finish it properly. Can you please find someone who may be able to suggest what I might be doing wrong? I will be ever so grateful if you can help. I have been reading your magazine for the last 10 years and have not come across an article on this particular problem.

SIDNEY ELKIN
Montreal, Quebec, Canada

I'm sorry to hear your sad tale. Modeling is supposed to be fun, not frustrating, and I'm afraid bad advice has spoiled your day. Hopefully it hasn't permanently spoiled your model. Both Sig Koverall and Pacer Technology's Z-Poxy are super products, but they're not designed to be used together.

Sig Koverall is a polyester fabric that is used in much the same way as you would use any of the shrinkable plastic coverings. You brush a glue (such as Sig Stix-it) onto the airframe to hold it in place. This glue is heat sensitive so you can tack the cloth to the framework, and the cloth is shrinkable so you can shrink it up just like the plastics. It has the advantages of being very strong and puncture resistant and, since it has no glue on the back, it won't stick to itself. This makes it easier to apply than the plastic coverings, but you do need to prime and paint it. It's best used for covering airplanes that would normally be fabric covered and typically, these have open-bay wings.

You do not use epoxy resins on this fabric, however. Z-Poxy is an epoxy-finishing resin that is best used with fiberglass cloth to produce a hard finish base on models with sheeted surfaces. It would work ideally on the fuselage of your Goldberg Extra 300 with 0.6- to 1.0-ounce fiberglass cloth as the base. I typically thin Z-Poxy with alcohol when applying it and just brush it on, working out any wrinkles in the cloth as I go. When you've finished, you'll have a hard, smooth surface and be ready for primer.

But the wings are not completely sheeted on your Extra 300. You could completely sheet the open area and then use the fiberglass/epoxy method of finishing, or you could apply Koverall, priming and painting it to match the fuselage.

I'm sure you're asking, "What do I do with this mess I have?" but it's a little hard to say from afar. If the Koverall is largely loose on the airframe, I'd suggest you tear it all off and start over. In those places where it is stuck, I'm afraid you're faced with a sanding chore.

Don't despair, though. You've gained some experience with a couple of superb products when it comes to forming a base for a painted finish. My personal preference for a plane like the Extra is to start with a fully sheeted aircraft and use Z-Poxy and a very light glass cloth as the base for the paint. LM

Pilot PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1998. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606.

¼-SCALE 90A

Harris Swartz of Houston, TX, writes that this Ikon N'West Monocoupe is his first big-bird R/C project. Weighing in at 17 pounds with a Zenoah G-38 in its nose, the model balanced perfectly and flies much like a trainer. Harris outfitted the plane with a mechanical door latch, brass tube empennage bracing and vacuum-formed wing attachment fairings. Using documentation from Bob Banka's Scale Research, Harris created the paint scheme with 21st Century fabric and paint and Model Graphics decals.

'60S CLIPPED WING

A. Lynn Lockrow of Auburn, AL, sent this photo of his ⅓-scale Monocoupe N2347. The 90-inch-span model weighs 27.6 pounds ready to fly and uses a SuperTigre 4500 with a Syntec adjustable hub for power. Covering and trim are Ultracote, and the plane features a full cabin interior with leather seats and detailed instrument panel. The N2347 was one of the original seven factory clipped wings (the design's fuselage was later changed to the 90A style).

AVRO VULCAN

Alan Walker of Derby, England, designed and spent four years building this Avro Vulcan out of balsa, ply, foam and fiberglass. The 121-inch-span, 43.5-pound model can reach top speeds of more than 100mph with its two O.S. .91VRDF engines and Dynamax fan units.

GOLDEN ERA RACER

This Howard DGA 5 Ike model was scratch-built from enlarged Henry Haffke plans by John Rugg of Courtenay, B.C., Canada. The 72-inch-span model weighs 15 pounds, uses a 1.50 Saito 4-stroke for power and features plug-in wings, a fiberglass cowl and wheel pants and functional rigging. The decals are from FM Graphics.

DECADES OLD P-47D

Burt Gordon of Beverly, MA, sent this photo of his latest project—a P-47D Thunderbolt Top Flite kit. According to Burt, the kit languished in someone's basement or garage for more than 20 years before he bought it in 1996, just after he got into the hobby. Two years later, he felt skilled enough to build it. The 47-inch-long, 60-inch-span model is finished in Hobbypoxy and powered by a Saito FA .91S 4-stroke and features functional flaps.

NAVY WACO

Richard J. Stommel of Orlando, FL, sent this photo of his Ikon N'West UPF-7, which has a 73-inch span and weighs 15 pounds dry. The model is covered in MonoKote with hand-painted details and is powered by a Moki 1.80 engine. Of the men who flew the full-size airplanes, Richard writes, "If you can imagine flying up to an airship going 40mph and trying to hook onto the extended trapeze that hung underneath the hull of the airship ... those [flyers] were the top gun pilots of another time."

PT-19 TAKES OFF

This ¼-scale Dynaflite PT-19 was built by Harold Davidson of San Jose, CA. The model sports a spring-loaded tailwheel, a baffled Enya 120 engine, Robart scale landing gear and wheels and Williams Bros. pilots and is finished in Super Coverite. Harold's flying buddy Jim Patrick took the photo. Both pilots belong to the Santa Clara County Model Aircraft Skyport Club, which has several members who flew full-size PT-19s during WW II training.

MR. MULLIGAN

Barry McLean of Whittier, CA, built this ¼-scale 1935 Bendix and Thompson Trophy winner. A Zenoah 45 with CH Jumpstart powers the model, and nine servos control the flaps, standard controls and a remote kill switch. The model also has a detailed cockpit and dummy 9-cylinder radial engine, and it's covered with 21st Century fabric and Custom Graphics decals.

DH MOSQUITO

Tore Hansen of Drammen, Norway, built this DH Mosquito from a British Aerotech International kit and added retracts, flaps and a scale cockpit. The 10-pound, 75-inch-span model also has all handmade markings. Tore writes that two O.S. .48 Surpass engines provide enough power for realistic flying and "play like an orchestra during the flight."

SUPER DECATHLON

Jeff Krotzer of Rockford, MN, built this Great Planes kit and covered it with 21st Century fabric, paint and decals. A 4-stroke Saito FA-80 turning a 13x6 propeller "provides more than enough power, and most flying is done around ½ throttle. The Super Decathlon does a nice job of aerobatics but is very easy to handle on landing," writes Jeff.

Pratt & Whitney fun fly

by LARRY MARSHALL

TO HAVE A GREAT fun fly, what do you need? You need a good place to hold it; you need people to organize it; and you need good weather. Put these three things together, and modelers can have a lot of fun and put on a good show for spectators who just want to enjoy a bit of vicarious modeling for an afternoon. When these three things come together, there are bound to be lots of smiles and possibilities for modeling folks to help promote our great hobby. These meets are the true "grassroots" of our hobby.


This Great Planes Learjet flew well and looked great on the tarmac.

And so it was at the first fun fly at Renschler Field, a large facility associated with Pratt & Whitney in East Hartford, CT. Dennis Thibodeau was the organizer. He realized how great this field would be for model airplane meets because he and his buddies fly NEPRO pylon races there every year. This site has also been used for full-scale airshows, as the runways are long enough to accommodate the large commercial airliners and fighter planes that use Pratt & Whitney engines. Pratt & Whitney management graciously worked with Dennis and provided access to the field for the fun fly. Dennis ran a great event, with "simple," "safe," and "fun" being the watchwords of the day. He added a nice touch by having the pilots park their aircraft near the spectator area so that people could get close to them and see why we do what we do.


While this Corsair flew with a SuperTigre in the nose, the clear cowl gives away the owner's intent to replace it with a scale P&W R2800 at some time in the future.

I don't know whether I should credit Dennis or Pratt & Whitney for delivering the great weather, but the ingredients came together, and I and the other 20 registered pilots had a great time flying. The array of aircraft was pretty typical of a general fly in event. There was a Sig 4-Star 60, a couple of OV-10s, a Learjet, a Bucker Jungmann, a Lanier Stinger, several trainers and even a helicopter. Everyone had fun.

Rick Bell brought this Goldberg Bucker Jungmann along. It was powered by a Saito 150.

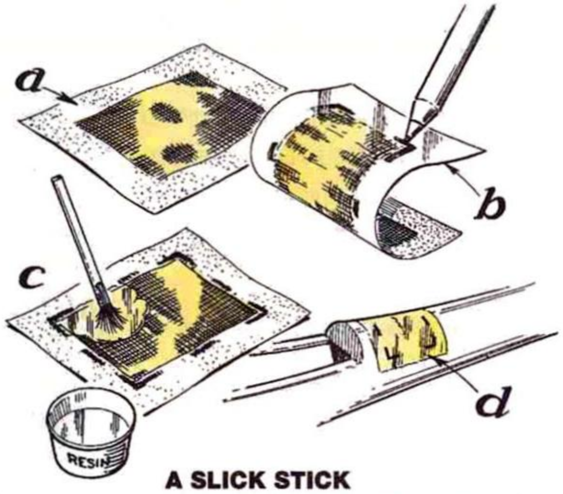
PHOTOS BY LARRY MARSHALL

This brace of Uravitch OV-10s put on a show with their solid flight characteristics and reliable engine performances.

Hints & KINKS

by JIM NEWMAN

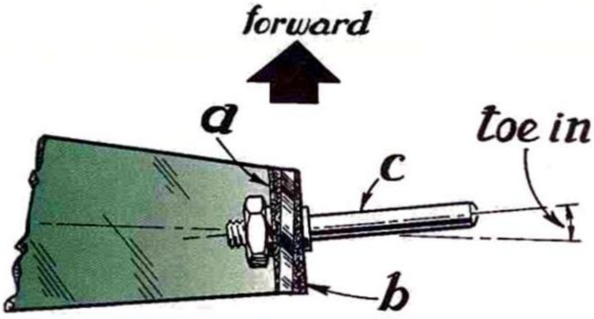
Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



A SLICK STICK

Here's a neat, mess-free way to apply a fiberglass patch. Press the dry fiberglass onto the sticky side of a piece of transparent parcel tape (a), then roll the tape over (b) to mark the position of the patch, which will be transparent when wet. Stipple the resin onto the patch (c), then apply it to the damaged area (d) using the black marks to center it over the break. Squeegee out all the air bubbles from under the tape then, when the resin has fully cured, peel the tape off and you will find a smooth, slick patch that requires little or no sanding.

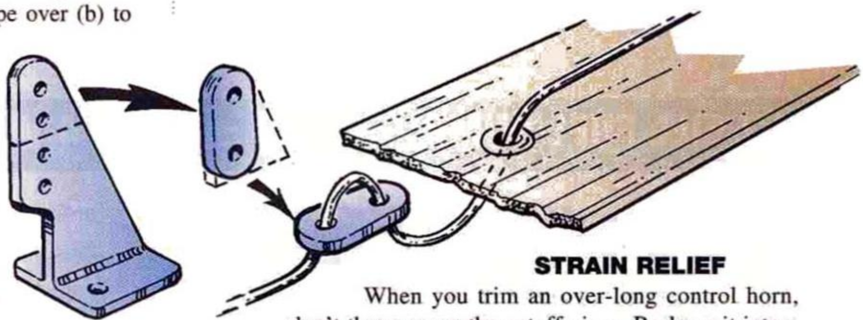
Jerry Mindes, Provo, UT



IN TOE

It's very difficult to adjust toe-in on sheet-metal or fiberglass landing gear, but smart use of Ernst tapered engine-mount thrust wedges solves this. Select wedges of the desired angle, then fit them as shown at (a) and (b), securing them with a drop of CA while you bolt in the axle (c).

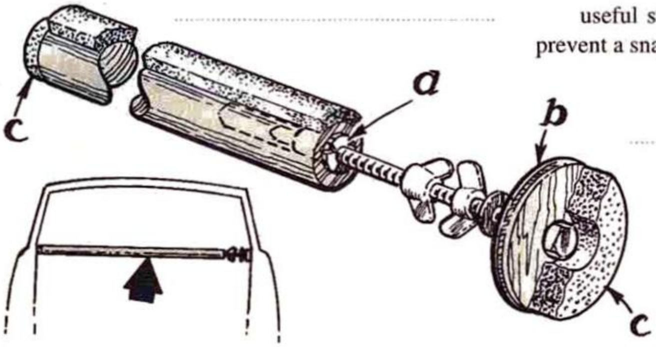
Eric Hofberg, West Chester, PA



STRAIN RELIEF

When you trim an over-long control horn, don't throw away the cutoff piece. Reshape it into a useful strain-relief button, and place it under the fuselage top to prevent a snagged antenna from being torn out of the receiver.

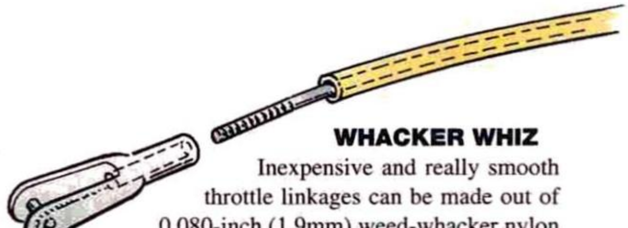
Jamshed Ishrat, Rawalpindi, Pakistan



BAR CRAWL

Make a pair of these expanding bars for your van or wagon and lay wings across them for traveling. Drill large-diameter dowel or square-section wood to accept a ¼-20 blind nut (a), making the hole deep enough to allow adjustment. Cut thick plywood (b) to go over the end of the bolt, then pad its face and the other end of the bar with foam rubber (c). Add wing nuts and a washer, pad the top with foam, then, when the bar has been fitted to your car, you can secure the wings with rubber bands.

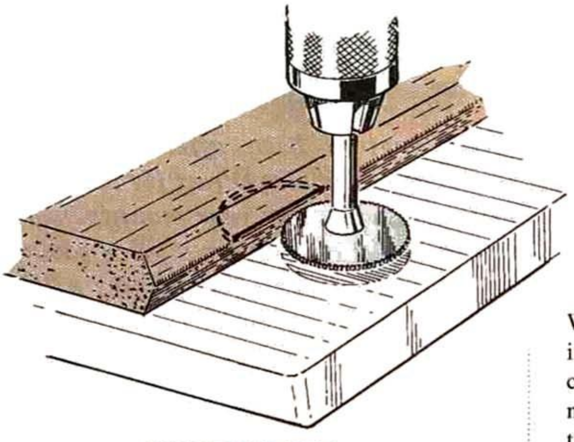
Harry Braunlich, Victor, NY



WHACKER WHIZ

Inexpensive and really smooth throttle linkages can be made out of 0.080-inch (1.9mm) weed-whacker nylon line and some ⅛-inch (3mm) nylon pressure tubing. Drill out an EZ connector with a no. 44 drill bit for the throttle arm, use a 2-56 nut to cut a thread on the nylon line, then thread the line into the clevis. Andy suggests Polypenco Nylaflow tubing, but a Nyrod tube should work, too.

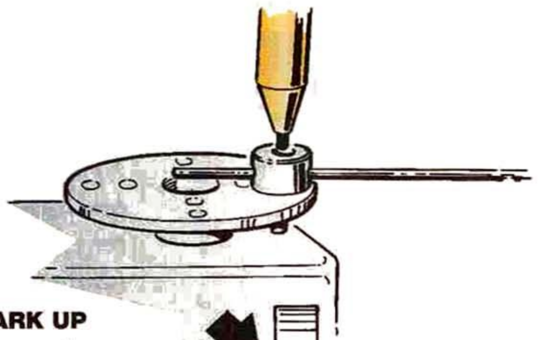
Andy Levino, Irwin, PA

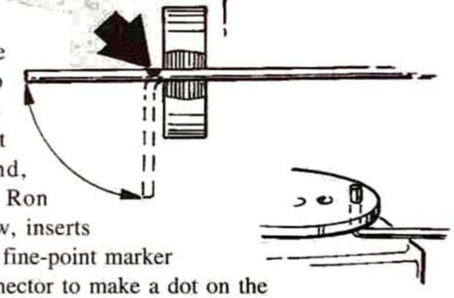


HINGE HELPER

Lock a Dremel slitting saw into your drill press, then lock the chuck at the correct height to cut hinge slits on the centerline of your stabilizer or wing trailing edge, etc. Keep your fingers well clear of the spinning saw blade; as small as it is, it can still nick your knuckles.

Len Klebanoff, Richmond Hill, Ontario, Canada

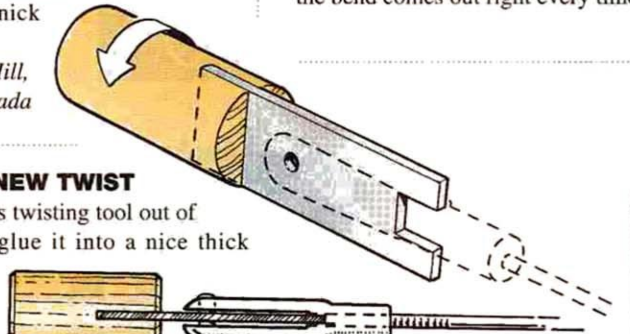




MARK UP

Where you have insufficient height to clear a pushrod connector, you can resort to a 90-degree bend, installed as shown. Ron removes the setscrew, inserts the wire, then uses a fine-point marker inserted into the connector to make a dot on the wire that shows where to bend it. Put the pliers' jaws at the dot, and the bend comes out right every time.

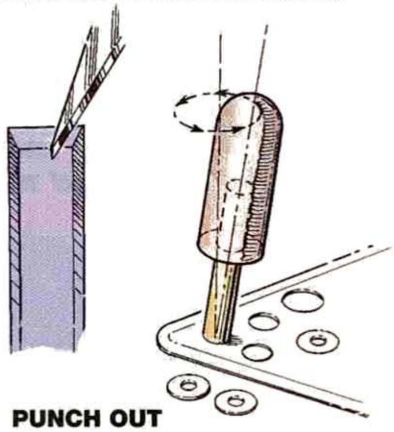
Ronald Motz, Akron, OH



A NEW TWIST

File and drill this little clevis twisting tool out of 1/16-inch (1.5mm) metal, glue it into a nice thick dowel handle, then use it to twist those hard-to-turn clevises onto the threaded rod. The fatter the handle, the greater the leverage on the clevis.

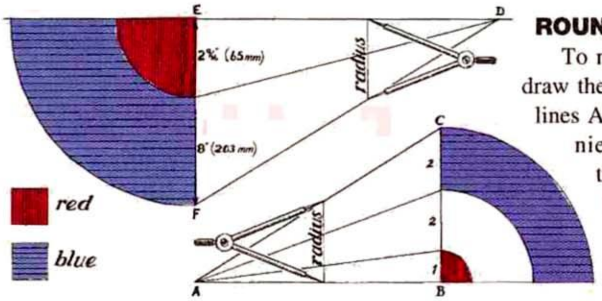
Eugene Zang, Centerville, VA



PUNCH OUT

Use a hobby blade to sharpen the inside edge of brass tubes, then glue those tubes into dowel handles. By pressing the tubes onto old playing cards, you can cut neat concentric circles and produce some very nice fiberboard washers, which everybody needs at one time or another. Peter recommends Bicycle playing cards for raw material.

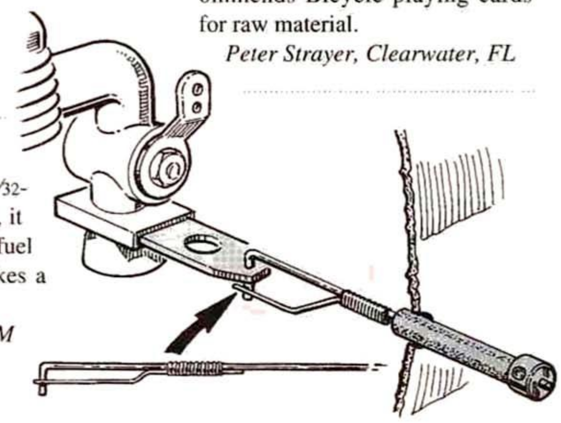
Peter Strayer, Clearwater, FL



ROUNDEL JIG

To make RAF roundels, first draw these simple triangles, with lines AB and DE of any convenient length. Draw BC in the ratio 1:2:2, and you have the right proportions for the red, white and blue for any radius you pick. For the red and blue top-surface roundels, draw EF to the dimensions shown, and again, you will have the proper proportions.

Eric Marsden, Horndean, Hants., England



PUSH/PULL

This quickly detachable push/pull is made using 1/16-inch (1.5mm) and 1/32-inch (0.8mm) music wire that's bound with soft wire and soldered. Here, it is used as a choke control that protrudes through the cowl. The rubber fuel line prevents it from vibrating against the cowl, and a wheel collar makes a convenient knob.

Frank Burchardt, Carlsbad, NM

The Oshkosh GIANT SC

16th Annual Joe Nall Memorial Fly In

Top: Arnold Marcus from Orlando, FL, beat up the sky with his impressive Ziroli P-38 Lightning. Brison Sachs 3.2 engines power the model, which is covered with chrome Ultracote Plus stick-on film and has Robart retracts and a JR 8103 radio. Bottom left: how's this for a big Lazy Bee! Built by Mark Davidson of Greenville, SC, this "Super Bee" is four times larger than the Clancy Aviation standard-wing model and has a 17-foot wingspan. The model weighs 80 pounds and is powered by an Air Hobbies 9.8ci engine. Bottom right: Bill Steffes of Schenectady, NY, came down to show off his beautiful, 1/4-scale AT-6 Texan. Built from enlarged Ziroli plans, Bill's model is powered by a Quadra 100 that's equipped with an electric starter.

PHOTOS BY GERRY YARRISH

of ALE

by GERRY YARRISH

Texans taxi out for the warbird formation flight.

***HELD EVERY YEAR** in Greenville, SC, on the weekend after Mother's Day, the Joe Nall Memorial Giant-Scale Fly In is an event that has become synonymous with quality and exemplary effort. Celebrating its 16th birthday, the Joe Nall Fly In, with its 3,000x400-foot, putting-green-smooth runway, is considered by many to be the Oshkosh of giant scale.*

Pat Hartness is the man behind the Joe Nall Fly In, and with the help of his many friends and R/C buddies, he has literally turned his front yard into one of the best flying fields you've ever seen. Yes, that 3,000-foot-long runway is part of Pat's front yard! The rest of his property includes a beautiful campground, two huge ponds and the headquarters for Pat's manufacturing and development business, Hartness Intl.

Back at the flying field, there is ample parking for several hundred vehicles and trailers, a centrally located gazebo that's used as R/C HQ, a large aircraft hangar and an attached, well-appointed workshop. Pat opens his hangar doors and takes his beautifully restored, full-size aircraft out to make room for the many models that need overnight storage and charging. His workshop is always available for the not-so-lucky modelers, and there are lots of tools and supplies on hand for various repairs. To say that Pat greets the many R/C flyers who attend his event with open arms would be an understatement.

Joe Nall Memorial Fly In

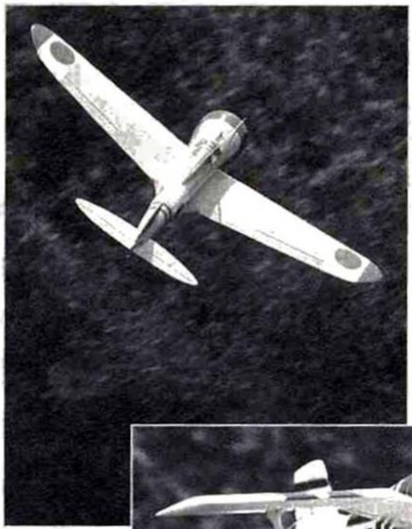
***Top left:** Tony the Tiger says, "The Joe Nall Fly In is gr-r-reat!" **Top right:** Mike Haspas brings his P-47 Thunderbolt in for a landing after strafing the runway. **Above:** Randy Smith of Atlanta, GA, flew this great-looking 1/4-scale S.E. 5a. It's powered by a Zenoah G-38 and covered with Super Shrink Coverite and dope; nice flier. **Left:** the work of Miles Reed, this 1-800-Collect Special is powered by a D&B 5.1ci gas engine.*

Dropped by Mac Hodges' B-29, this miniature Bell X-1 is piloted by Don Stevens. When he lights the "candle," the little orange sound-barrier buster rockets back up to altitude. Very impressive.

***Above left:** Jim Wilkinson's FW-190A-8 takes off for another sortie over Greenville. Powered by an O.S. 300 and featuring scratch-built scale retracts, the 190 earned Jim a sixth-place win in Expert at the 1998 Top Gun invitational. **Above:** no, that's not Delmar Benjamin; it's Andreas Gietz of Germany flying his 1/3-scale Gee Bee Model R-1. The huge golden-age racer is powered by a Siedel radial engine. **Right:** time to make some noise.*

The Joe Nall Fly In is open to AMA modelers and their guests, but the event is closed to the general public. With all of its refinements, Hartness Field *is* a country park setting, and Pat has found that R/C'ers tend to keep his property clean and litter free and are always willing to cooperate when things need to be done. Folks start coming in as much as a week early, and many set up camp for the duration. By Friday, the flightline is wall-to-wall planes.

A separate section, closer to the main gate, is set aside for vendors. An amazing barbecue is held in Pat's backyard on Saturday night. I am absolutely astounded at how quickly Pat and his wife, Mary Lou, feed everyone ... would you believe more than 1,000 folks in about 40 minutes? Pork, chicken, slaw, baked beans, shrimp, bread and beverages make it a meal you don't walk away from hungry; just remember to bring a folding chair.



Left: a 1930s era Mitsubishi A5M streaks skyward in defense of the airstrip as Allied fighters zoom overhead! Below: built from Model Airplane News plans (no. FSP03841), this Cobra double gull-wing biplane is piloted by C. R. Price. Spanning 76 inches, the model is a Dan Santich design.

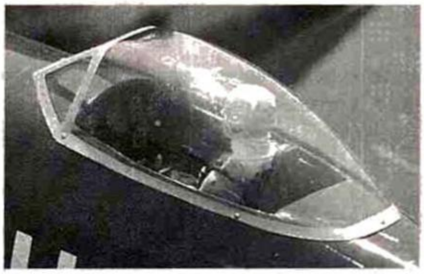
IN THE AIR

Though the event is a low-pressure, anyone-can-come, giant-scale fun fly, the weekend is punctuated with the unusual, and some really exciting flying takes place. Many well-known modelers show up at Hartness Field just to relax and have fun. It's that "having fun" part that makes the event so successful.

The field has six flightlines, and this year, there were over 500 registered pilots and some 1,500 models on display. CD Mike Gregory and announcer Bob Sadler kept everything running smoothly, and diehard fliers weren't disappointed with the amount of flight time they got.

There's an airshow at noon every day, and that alone is worth the trip. This year, the show started off with an impressive demonstration flight of a FiberClassics* ⅓-scale Gee Bee model R-1 flown by Andreas Gietz of Germany. The Gee Bee was powered by the new Siedel 7-cylinder radial engine and sounded like an airborne Harley! Speed and power were awesome, as Andreas did a good imitation of Delmar Benjamin's full-size airshow, complete with slow and 4-point rolls; very impressive!

The next act was a fun-to-watch hovering/torque-roll contest with some very talented pilots. Frank Noll, Warren Thomas, Jerry Neel and Don Szur battled it out in the "how low can you go" contest. Rudders did touch grass several times during the show, and the louder the crowd cheered, the braver the pilots got.



A canopy study in blue; the pilot in William Vollmer's beautiful Hawker Sea Fury awaits his turn on the flightline.

Next up was a very impressive showing of warbirds headed by members of the Southern Scale Warbird Association. Bob Preston, Charlie Keil, Chris Joiner and announcer Doug Imes organized the warbird portion of the show with military-like precision. The fighter flights were some of the best to be seen anywhere. B-25s, Mustangs, Messerschmitts and Zeros all took to the air, and several formation flybys added to the air invasion. WW I aircraft were also on hand; Fokker triplanes seemed to be everywhere, as were "between the wars" aircraft such as Stearmans and Piper Cubs.

Mac Hodges of aerobatic B-29 bomber fame was also at Joe Nall, and this year, he added a new twist to his act. In keeping with a historical flavor, Mac now includes a Bell X-1 air drop as the opener of his show. Don Stevens stands in for Chuck Yeager, and after his fairly steep gliding flight from the mothership, Don lights a rocket engine in the tail of the X-1 just before touchdown and zooms back up to altitude. The crowd loves it every time.

The show continued with the help of mock golden-age pylon racing, pulled together by Gary Doren and featuring a Ryan ST Special, several Wedell Williams racers and a Miss Los Angeles

Left: the Giles G-202 aerobatic aircraft is becoming very popular with both TOC and IMAC pilots alike. These giants were very much a part of the Joe Nall experience. Left to right: Mike Salus, Dennis Gergits, Andy Kane and Frank Noll. Right: Carden Aircraft's Dennis Gergits shows us just how big his 41-percent-scale Giles G-202 really is.

Joe Nall Memorial Fly In

thrown in for good measure. The crowd was entertained with the best imaginary racing (and cheating!) you ever saw; talk about cutting pylons! But as is always the case at the Joe Nall Fly In, it's all meant to be fun, and it truly is.

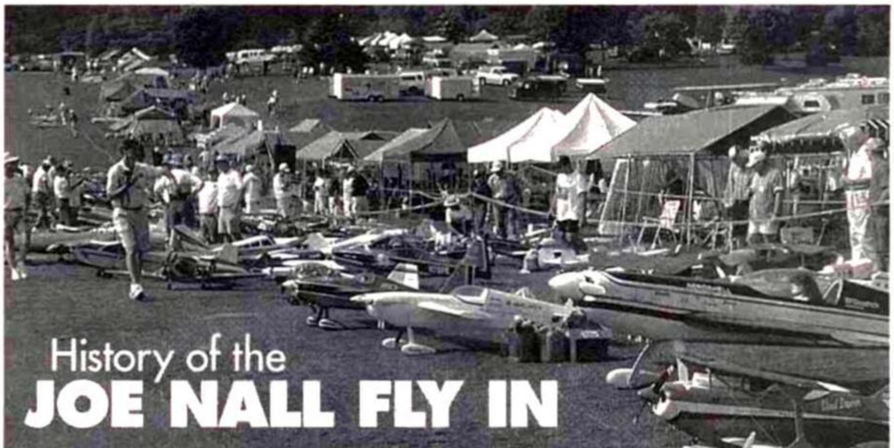
Top: general assistant at large Kirby McKinney (left) presents the Joe Nall award to this year's recipient, Chaz Frye. Each year, the award is given to a modeler who has contributed to promoting R/C. Bottom: Pat Hartness (center) is presented with an honorary lifetime membership to the IMAA by its president, Bob Dean (left).

For many of the spectators, the icing on the cake is when all the models line up, wingtip to wingtip, down the center of the runway. This year, Pat flew his Piper J-3 Cub from the field and brought along my buddy Jerry Smith for an aerial photo session. The crowd got to see the models up close, and the sight of all those beautiful models stretching nearly the entire length of the flying field was really an impressive one.

AWARDS

Though there is no real competition, awards are given each year at the fly in, and this year, a special presentation was made. Bob Dean, president of the IMAA, awarded Pat Hartness an honorary, lifetime membership to the IMAA, and this took Pat completely by surprise.

Chaz Frye of Marietta, GA, was this year's recipient of the Joe Nall Award. This award is given to someone who goes above and beyond in supporting the hobby and who makes an effort to help fellow modelers. Doug Imes, the warbird show announcer and AT-6 Texan pilot, earned the Bob Smith Award for the most scale-like flight.



History of the JOE NALL FLY IN

In May 1983, the IMAA chartered the Confederate Air Farce (CAF) as Chapter 94. The CAF was given its name by Ed Siebold, and its best features were: no dues, no meetings and no problems.

The CAF wanted to promote giant-scale R/C and set about organizing an event that would take place on the first weekend after Mother's Day at Hartness Field in Greenville, SC.

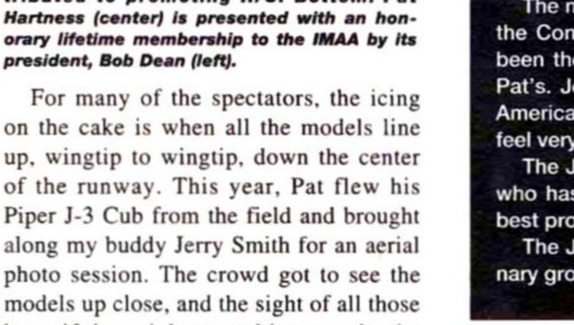
About 15 pilots showed up at that first event, and all who attended considered it a success. Each attendee received a plaque and since then, plaques have been given to all registered pilots who participate.

In 1989, the Bob Smith trophy was given to Tyke Hale of Virginia in recognition of his flying skills. Bob Smith had attended the event for many years and had come to love not only the fly in but also the hobby of giant scale. The trophy is used to remember him and, for the past nine years, has been presented as a traveling trophy to one of the participants.

The next change occurred in 1990, when Pat Hartness asked to have the name of the Confederate Air Farce's Greenville meet changed to honor Joe Nall. Joe had been the announcer at the Greenville meet for years and was a longtime friend of Pat's. Joe died in an airplane crash while on assignment with the NTSB in South America. He had a remarkable memory for names and faces and made everyone feel very special. His love of aviation and of R/C inspired everyone who knew him.

The Joe Nall trophy (also a traveling award) is presented annually to the modeler who has best demonstrated his love of R/C by helping others and whose actions best promote the hobby. Curtis Mees received the award last year.

The Joe Nall Fly In could not possibly be held without the efforts of an extraordinary group of about 35 volunteers who bring it all together each year.



Mike Grogan's JU-87 Stuka dive-bomber takes a break in the pits after an exciting mission. Mike was flying his G-62-powered Stuka on a bombing run when the model suddenly veered sharply off course. One of the ailerons had come loose and was sticking into the airstream. Good piloting skills led the Stuka safely back onto the ground with no other damage.

THE FUTURE

Ask anyone who has been there, and you'll learn that the Joe Nall Fly In is one of the most popular annual events you could attend. In fact, it has become so popular that it has just about outgrown its present location. To solve this problem, Pat has undertaken the construction of a new facility that will be bigger and even more impressive. The rumor is that besides giant-size R/C models, the new facility will also be used to host EAA experimental aircraft fly ins. If Pat Hartness is involved, you know it will be grand.

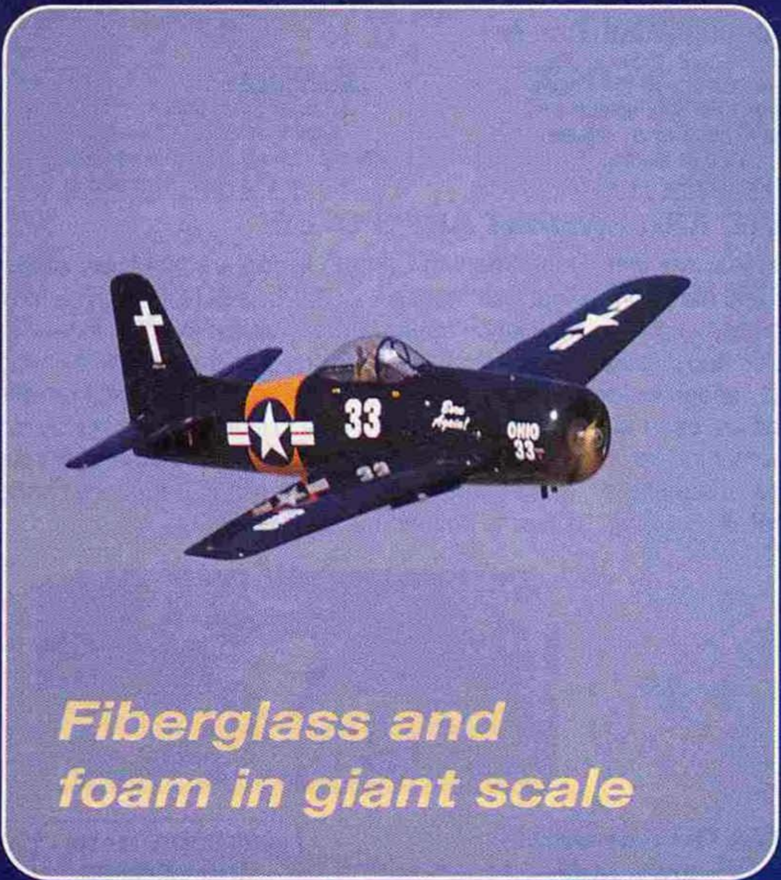
If you love big models, mark the calendar for next year's event and see for yourself what the Joe Nall Fly In is all about. You can obtain a registration form from IMAA Chapter 94, 20 Rocky Way Point, Greenville, SC 29615. You may also visit the Joe Nall Giant-Scale Fly In website at www.hartness.com/events/.

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

AMERICAN EAGLE

F8F Bearcat

by RICK MICHELANA



Fiberglass and foam in giant scale

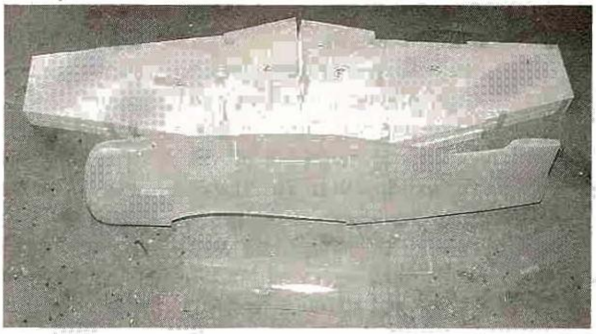
Living in south Texas has its advantages. One of those is year-round flying, as we have only three seasons: December, January and summer. "Year-round" flying means that we don't like to spend more time in our shops than we have to. In my experience, nothing builds faster or lighter than glass and foam kits, and this is the primary reason I became interested in the American Eagle* product line.

I met Bob Neider, who owns and operates American Eagle, during the 1997 gathering of B-17s and other big birds at Bomber Field in Monaville, TX. I had seen Bob's ads in the IMAA magazine, and I was quite impressed with his inventory of giant-scale, epoxy/glass and foam WW II airplanes.

CONSTRUCTION

This is a builder's kit. You must be familiar with model construction; however, you do *not* need to be a master builder. American Eagle offers a very good-quality fuselage, cowl, belly pan, foam wing-cores, canopy, plans and a basic instruction manual.

Begin by assembling the skins for the wings, stab and vertical fin. I used $^3/_{32}$ balsa sheet on the wing,



The foam and fiberglass parts out of the box.

SPECIFICATIONS

Manufacturer: American Eagle

Model name: F8F Bearcat

Model type: 1/5-scale WW II fighter

Length: 69 in. (tail to prop nut)

Wingspan: 86 in.

Engine used: Quadra 75cc w/stock muffler

Propeller: Zinger wood 22-8x14

Channels req'd: 6 (flaps and retracts)

Radio used: Futaba 6 NFK FM

Servos used: Hitec 615 B.B. Metal Gear

List price: $410

Features: multi-layer epoxy/glass fuselage, cowl, belly pan, foam wing-cores, stab, vertical fin, canopy, plans and instruction booklet.

Comments: for modelers who like big birds, especially those who fly WW II fighters.

Hits
- Gets you into the air quickly.
- Excellent flight characteristics.
- Documentation sheet supplied.

Misses
- No CG shown on the plan (new plans will be updated).

with 1/16 balsa sheet on the stab and vertical fin. When all skins have been made, figure out where the servos and retracts will go and, using a straightedge as a guide, make channels in the foam wing-cores with a soldering gun with a 1/2-inch-deep semicircular tip made of electrical house wiring. The channels will allow you to run servo wires and retract tubing later. Also, to strengthen the wings and eliminate the use of spars, run a few bands of self-adhesive, fiberglass wall-joiner tape spanwise on the top and bottom of your wing. Then, sheet the wings, stab and vertical fin. The Bearcat plans show fabric on the flight controls, so I made built-up structures using 1/8-inch balsa cut to flight-control shape, 3/8-inch balsa LE and 1/8-inch balsa false ribs on both sides. These can be made quickly and easily, and they look good when covered in Super Coverite*.

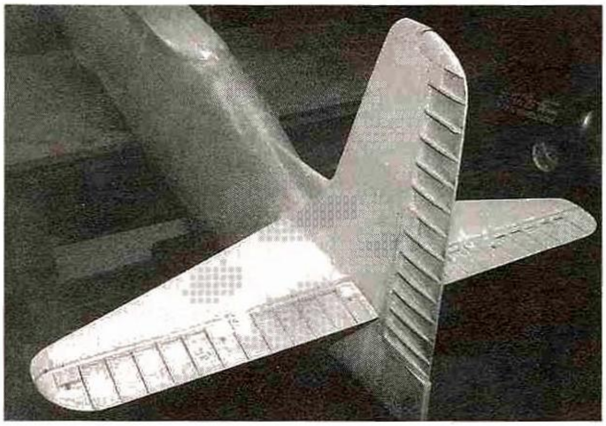
No bulkheads are required in the fuselage. I added a half bulkhead for the Robart* retracting tailwheel I used and glued this in with Hobbypoxy* Formula 3. When adding servo plates or rails in an epoxy/glass fuselage, you can simply install them with thin CA. For added strength, add a fillet made with Hobbypoxy 3.

I wanted to get in the air fast, so instead of installing a full cockpit, I settled for a 1/5-scale pilot bust and then semi-detailed the area within the cockpit.

I attached a plywood firewall to the glass firewall after bolting the wing into place. I used a Quadra* Q-75, and the Bearcat's cowl is so big that the engine and muffler are concealed.

COVERING

Let's do the fiberglassing first. The wing will be finish-sanded with only 100-grit paper and a sanding block. Use spackling or light filler to make everything level. Once all surfaces have been sanded smooth, lay 3/4-ounce cloth on the surface to be covered with the cloth cut slightly larger. Now use Hobbypoxy white paint and the gloss hardener that goes with it. Combine equal parts and then add Sherwin-Williams no. 54 epoxy reducer (used to clean spray equipment) until the paint is the consistency of milk. Brush this onto the cloth, painting the cloth down from the middle of the wing and working out. Then cover the remaining parts. Let everything dry



Above: the stabilizer is built up using 1/8-inch balsa cut to flight-control shape, 3/8-inch balsa LE, and 1/8-inch balsa false ribs on both sides. Below: the Bearcat is all framed up and ready to be fiberglassed.

for about 1½ hours. Sand all the overhanging glass with 150-grit paper. Now, the glass can easily be cut, leaving a nice finished edge. Turn the parts over and do the other sides.

The advantage of covering with glass and paint is that you can totally fuelproof even the most intricate areas just by painting them. Once dry, sand the edges with 150-grit paper. Your wing and other parts (stab and fin) should now be covered and ready for another coat of paint. For built-up construction with open bays, I use Coverite Supershrink and have done so for years. Sand the parts to be covered with 150-grit paper and apply Balsarite* for fabric. Attach all Coverite with the grain running spanwise and iron it down. When the flight surfaces have all been covered, hinge them using Robart 3/16-inch large hinge points.

With everything hinged and sanded, we can now begin the process of priming for paint. Paint will not hide poor preparation; whether it comes from a can or a gun, it only emphasizes the

FLIGHT PERFORMANCE

The Quadra 75 came to life with one flip of the stock spring starter. I am a definite believer in the stock Quadra 75 for all giant-scale warbirds. No electronic ignition for me! With an ignition engine, when the battery dies, the engine stops. When a magneto is used, you have the fire (spark) in the combustion chamber as long as the engine is turning. It doesn't get any more reliable than this.

• Takeoff and landing

I taxied the big Bearcat to the arrival end of the runway, advanced the throttle and simultaneously applied almost full right rudder. I have much experience with tailwheel warbird fighters and have come to realize that this is standard procedure. The Bearcat tracked straight and was rolling on the mains instantaneously. With only a 50-foot rollout, the mains broke free from the bonds of gravity and the model was airborne. The Bearcat flies very directionally and, like a bullet, goes where you point it.

I land all my models in the same way: on the downwind leg, reduce the throttle by ⅔ and maintain altitude, and airspeed will naturally bleed off. Extend the gear and flaps. Now, for the real secret to making good landings: release backpressure on the elevator, and as the nose begins to sink, apply up-elevator trim so that you now have no backpressure on the elevator gimbal. Good landings come only from stabilized approaches. The Bearcat landed ever so softly on its mains, as I reduced power when the wheels were just inches off the runway.

• Low-speed performance

This model is very stable with the flaps deployed to 30 degrees. Flying full-size planes has taught me to fly models with the same techniques. Whenever you change airspeed, you must change your trim. If you never use the trim knobs, you aren't flying your airplanes as they were meant to be flown. With power reduced to ⅓, and the flaps down and trimmed for level flight, the Bearcat will hang in the air with no bad tendencies. Many modelers in our club estimate a 15mph forward speed.

• High-speed performance

The Quadra 75 has 8hp to pull this 25-pound plane. This aircraft has good high-speed capabilities and actually behaves like every giant warbird I've ever flown: too fast for true scale flight appearance. Most of my showboating is done at ¾ throttle. When it's time for big loops or Immelmann turns, I simply crank in the remaining power on the way up.

• Aerobatics

There's no scale maneuver that this airplane is *not* capable of. The biggest limitations will be those of the pilot. If you are brave enough, this bird will do it. Our club is noted for the number of modelers who fly low-level aerobatics. When I make an inverted pass 5 feet off the deck with this warbird, our spectators really get a thrill. Does this take a lot of talent?—absolutely not; though it does take a lot of trim. It amazes me how many modelers will roll inverted then sit there holding the stick forward. Please don't do this. Roll in down-trim for a hands-off condition at the speed you desire, and then just fly. If you are inverted 5 feet off the ground and not in trim, all it takes is one hiccup, and it's over.

The American Eagle Bearcat is one fine flying machine. I now have over 60 flights on this aircraft and have had it at two airshows. It's one model that will get everyone's attention.

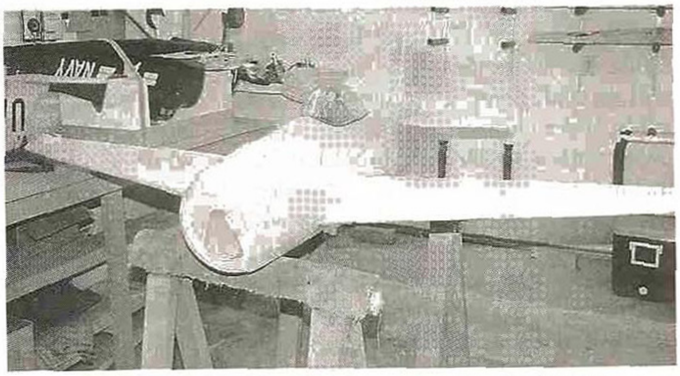
surface it rests on.

I use lacquer primer, glazing putty, plastic spreaders and lacquer thinner. Throw a portion of lacquer primer on the wing and spread it. This forces it into the weave of the fiberglass cloth. When it's dry, simply sand again with 150-grit paper. This must be done before you spray the first primer coat. You'll be amazed at how good your first coat of sprayed primer will look.

Spray the fuselage with one coat of primer to expose the pinholes that are common in all fiberglass products. To solve this problem, mix some primer with glazing putty in a 50:50 ratio. Thin this mixture with a little lacquer thinner to ease spreading.

All lacquers shrink during the drying process, so you may need to use two or three coats. Don't worry about weight, and continue to build up the areas that have defects. You'll sand most or all of this off, leaving only the filled pinholes. After everything has been sanded, spray primer and fix only the areas that need attention. When all has been done to your satisfaction, spray with a final primer coat and sand with dry 220-grit paper to level the primer surface and remove any excess. I final-sand for painting using maroon Scotch-Brite pads. Now the model is ready for painting.

I use only lacquer auto paints for the base and Krylon Interior/Exterior for all trim and color changes. When the entire model has been painted and all trim colors have been added, wet-sand very lightly with 600-grit paper. Dry everything thoroughly, wipe it all down with a tack-cloth, and then spray on clearcoat (lacquer or urethane). The urethane clear will make the paint look very glossy and wet; the lacquer will provide a more satiny finish. The Bearcat is now ready for radio installation and flight test.



The fuselage has been primed and is ready to be painted.

AT THE FIELD

I called a couple of my friends, and we headed to our flying field in Edinburg, TX. We have a 150x700-foot section for model use and also a 3,500-foot paved clearway on the end of the model runway in case we want to land a little hot!

The American Eagle Bearcat is one incredible flying airplane. If you can fly a .60-size pattern ship, you will have no problem flying this giant-scale WW II fighter. You must know how to build before you tackle this project, but you do *not* need to be a master builder. If your time is worth anything, you'll see that the amount of finished work in this and other American Eagle kits makes them well worth the asking price.

Addresses are listed alphabetically in the Index of Manufacturers on page 134.

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

High-flyin' .40-size ARF

by JIM ONORATO

SPECIFICATIONS

Model name: CAP 231EX 40 ARF

Manufacturer: Great Planes Model Mfg.

Type: sport-scale ARF

Wingspan: 64 in.

Wing area: 612 sq.in.

Airfoil: symmetrical

Weight: 6 lb., 10 oz.

Wing loading: 24.9 oz./sq.ft.

Length: 53.5 in.

Radio: 4- to 5-channel with 5 servos

Engine req'd: .40 to .51 2-stroke or .70 to .91 4-stroke

Engine used: O.S. FS-70 Surpass

Street price: $199.99

Features: all-wood construction with a minimum of plastic parts. Major assemblies are pre-built and factory-finished with MonoKote. A very complete hardware package is included.

I don't usually build or fly ARFs, but when *Model Airplane News* asked if I would like to review Great Planes* CAP 231EX 40 ARF, I was happy to oblige. I had seen the ads for this MonoKote-covered ARF and was anxious to see how it compared with the many "plastic skinned" ARFs on the market.

THE KIT

The word "kit" really doesn't generally apply to ARFs and certainly not to the Great Planes CAP 231EX. This plane is 90-percent complete and includes most of what you need to get flying—all except a radio, engine, propeller and fuel tubing. It even comes with a small quantity of epoxy! (You may also want to add a scale pilot figure as I did.) As usual, Great Planes has done an outstanding job of

Great Planes Model Mfg. CAP 231EX

packaging its product. Each main part of the plane is wrapped in its own plastic bag.

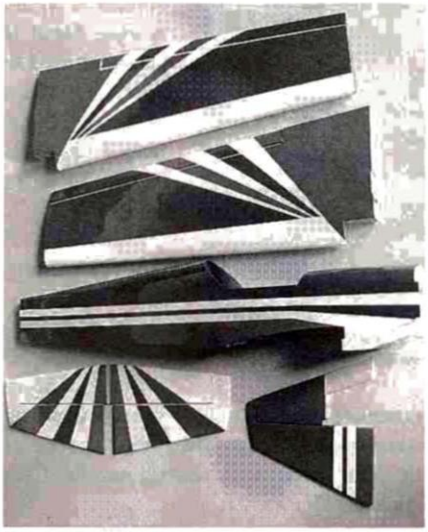
The CAP 231EX is factory finished with sapphire blue, white and teal Top Flite MonoKote and includes an adjustable, glass-filled nylon engine mount, fuel tank, wheels, spinner and a generous supply of Great Planes hardware. A well-written, 28-page instruction booklet guides you every step of the way without the need for full-size plans.

Comments: the CAP's large control surfaces provide exceptional maneuverability.

Hits
- Repairable wood construction.
- Excellent aerobatic flight performance.
- Easy-to-follow instructions.
- Generous supply of Great Planes hardware included.

Misses
- Wrinkled covering.
- Weak landing gear.

PHOTOS BY JIM ONORATO & WALTER SIDAS



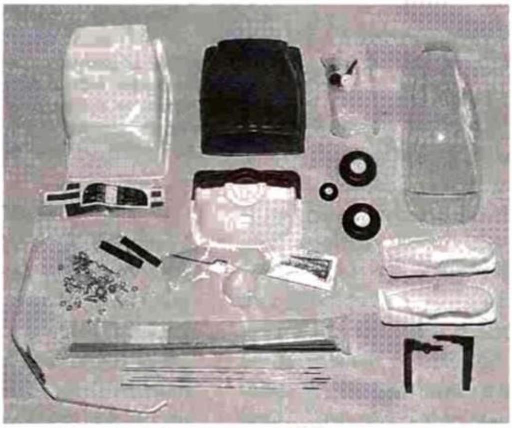
The CAP 231EX is factory finished with sapphire blue, white and teal MonoKote.

The MonoKote colors are brilliant but, unfortunately, the covering on the plane I received had a lot of wrinkles that didn't all come out when heated with a heat gun or iron as suggested in the instructions. This was especially true where one color was applied over another and on sheeted surfaces. On the other hand, MonoKote does make the plane easy to repair, so I guess it's a good tradeoff.

WING AND FUSELAGE ASSEMBLY

The first steps in assembling the CAP were to remove the covering from the aileron servo openings on the bottom of the two wing panels and then to glue the panels together. A hardwood wing joiner that slides into pockets in the wing panels is used to join the panels. I aligned the panels and glued them together with 30-minute epoxy.

The wing panels are supposed to be joined upside-down with the top of the wing flat on the work surface to set the proper dihedral angle. When I did this, however, there was a gap on the top edge of the root ribs. Since the fit was otherwise very good, I decided to increase the dihedral angle slightly by raising the center so the root ribs could be glued tightly together.



An adjustable, glass-filled-nylon engine mount, fuel tank, wheels, spinner and a generous supply of Great Planes hardware are included.

A neat feature of the CAP is the method used to secure the wing to the fuse. The CAP uses a wing-locking block at the leading edge instead of dowels. This block locks under a similar block that's already installed in the fuse. Make sure the wing block is aligned with the top of the wing when it is epoxied into place.

There really wasn't much to do on the fuselage, as it was essentially complete. I installed a 1/4-20 blind nut in the wing mounting plate and aligned and attached the wing. After I had glued the wing-bolt cover into place, I covered the center joint in the wing top and bottom with tape.

The remaining fuselage assembly steps involve installing the engine mount, test-mounting the engine and then installing the throttle pushrod and fuel tank.

TAIL FEATHERS AND LANDING GEAR

I removed the covering over the stabilizer and vertical fin openings and attached the stab and fin using 30-minute epoxy. The stab was a little loose in the fuse opening, so I added a 1/64-inch ply shim before gluing. (Note: the side with the most decorative covering is the top of the stabilizer.)

The tailwheel assembly and landing gear were installed next. The landing gear is pre-formed aluminum and is attached to the fuse with two 8-32 socket-head capscrews and blind nuts. I was pleased to see such high-quality hardware being used on an ARF but was later disappointed when the aluminum landing gear proved to be a little weak. The wheel pants are vacuum-formed ABS plastic and come in halves that have to be glued together with CA. Normally, wheel pants are made

FLIGHT PERFORMANCE

• *Takeoff and landing*

I like to take things a little easy with a new airplane, so I set the controls to low rate for the first takeoff. I pointed the CAP 231EX down the runway, applied a little up-elevator to keep the tail down and advanced the throttle. As soon as the plane began to roll, I released the up-elevator to let the tail come up. The plane tracked beautifully with just a touch of right rudder. When flying speed had been attained, I applied just a touch of up-elevator, and the model lifted smoothly into the air without rotating. Very realistic!

The CAP 231EX bleeds off airspeed fairly rapidly, so it is necessary to keep a few clicks of power on until you are almost on the ground. The easiest way to land this plane is to land slightly faster than stall speed and on the main wheels. If you let it get too slow, it's likely to drop a wing or suddenly just drop to the ground. (That's how I discovered that the aluminum landing gear was a bit weak!)

• *Low-speed performance*

The CAP 231EX flies smoothly at low throttle, but you have to be careful not to let it get too slow. While its stall is not violent, it is not usually straight ahead and not at a very low speed. The best thing to do is to test the stall speed at a safe altitude and adjust your flying accordingly.

• *High-speed performance*

I hesitate to use the words "high-speed" because the CAP 231EX was not a barnburner, even at full throttle. Powered by an O.S. FS-70 4-stroke, it had a relatively narrow speed range, which suits my flying style to a T.

• *Aerobatics*

The CAP 231EX was designed for aerobatics and is capable of performing enough maneuvers to keep most Sunday flyers happy. Its rolls can be slow and realistic at low rate or quite fast at high. The CAP 231EX does large inside and outside loops without losing heading and flies inverted with very little down-elevator. I did encounter rollout at the top of full-elevator deflection loops at high rate, but I eliminated the problem by reducing elevator throw. When the controls were set to high rate, the snap rolls and spins were very crisp. Sustained knife-edge flight and wild tumbling maneuvers were a breeze!

Overall, the Great Planes CAP 231EX 40 ARF is a great flying airplane!

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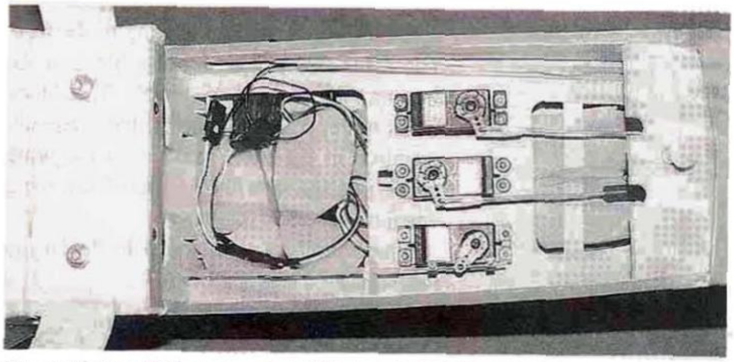


The radio installation was straightforward, and there's plenty of room in the fuselage. I added cross-braces under the servo tray to strengthen it.

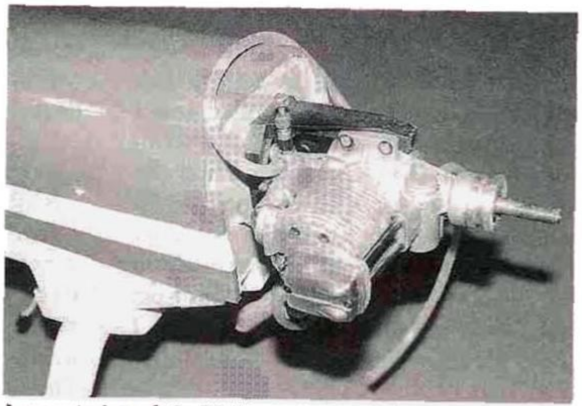
such that one half slips inside the other, but these were a little different and required a slight modification. Each side has a flange halfway around its perimeter; on one pant it was on top, and on the other it was on the bottom. To interlock the halves as intended, I had to cut slots in the front and rear of each side. After the sides had been glued together, I filled the seams with a mixture of micro-balloons and epoxy.

RADIO AND ENGINE INSTALLATION

The CAP 231EX comes with pinned nylon hinges, which I used on all the control surfaces. These were epoxied into place after I had coated the hinge pins with a little petroleum jelly to keep them working freely. The radio installation was straightforward, and I only made two minor modifications. I added cross-braces under the servo tray to strengthen it, and I installed the aileron pushrods perpendicular to the hinge line of the ailerons rather than perpendicular to the leading edge as shown. I used five standard-size servos for control.

Great Planes recommends a hot 2-stroke such as an O.S.* .46FX or a SuperTigre* G45 with a Pitts-style muffler or, for unsurpassed power and realistic sound, an O.S. FS-70 4-stroke. I chose the FS-70, which I mounted on its side using the adjustable engine mount provided. With the engine in this position, the stock muffler was tucked neatly under the engine and completely concealed within the cowl. I cut relatively small openings in the side of the cowl for the valve covers and a large opening in the underside of the cowl just in front of the firewall for cooling air and exhaust gas to exit. The cowl comes in top and bottom halves; the top is painted blue and the bottom is white. A blue decal is also provided to match the trim on the side of the fuse. I liked not having to paint the cowl.

Installation of the instrument panel decal, optional pilot figure and vacuum-formed canopy completed the assembly. The kit included some gold trim tape that I used to conceal the joint between the canopy and the fuse. Nice touch!



I mounted an O.S. FS-70 4-stroke on its side using the adjustable engine mount provided. The engine provides more than enough power and has a realistic sound.

The stock muffler is tucked neatly under the engine and is completely concealed within the two-piece cowl. I cut relatively small openings in the side of the cowl for the valve covers and a large opening in its underside, just in front of the firewall, for cooling air and exhaust gas to exit.

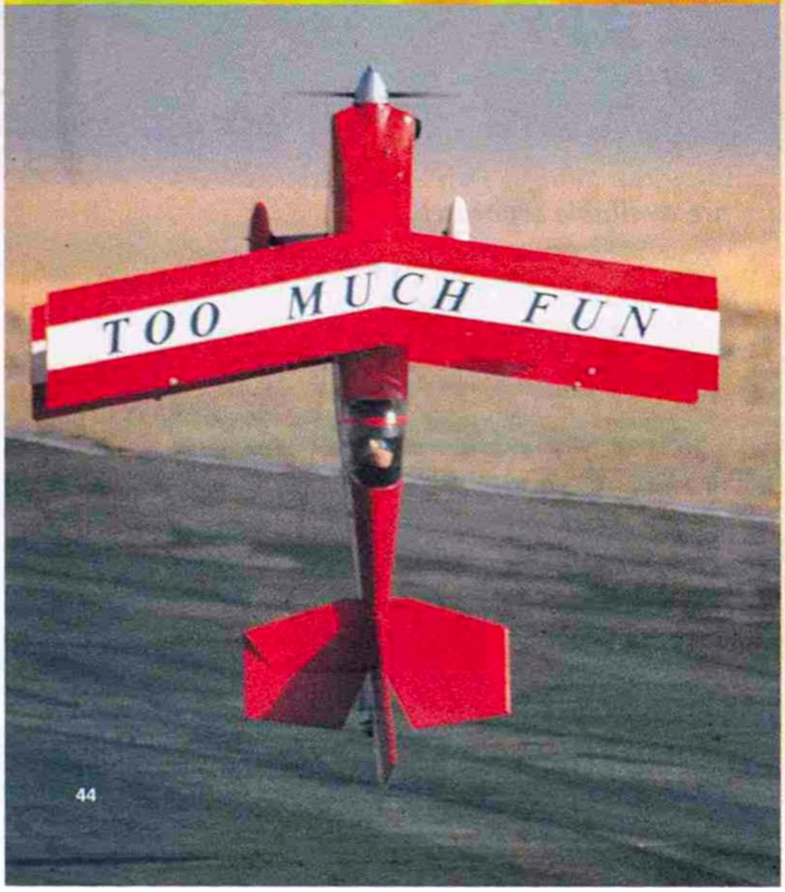
CONCLUSION

I found the CAP 231EX to be a well-made ARF that went together easily and looked quite good when completed. If you want to get onto the air quickly with something that looks like a real airplane and flies great, then the Great Planes CAP 231EX 40 ARF may be for you. I really like this one!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

WHY IS IMAC SO HOT?

A growing world of fun ...



by DAN WOZANSKI

NO MATTER WHICH way you turn, manufacturers seem to be churning out IMAC- (International Miniature Aerobatic Club) style airplanes, engines and accessories at a phenomenal rate. With the recent onslaught of CAPs, Giles and Extras, the scale aerobatic enthusiast has at last found utopia, after a long period of Ugly Stiks and Kaoses. But is this hot trend in the modeling industry based on the airplanes, the thrill of competition, or both?

IMAC has been around for over 24 years, and its original intent and premise have managed to remain fundamentally intact for nearly a quarter of a century because of their simplicity. IMAC's goal is simple: "to duplicate full-scale aerobatics with R/C aircraft in a realistic manner that is challenging for the contestants as well as interesting for the spectators."

So what is IMAC all about? Basically, IMAC competition is broken into two completely separate events: Compulsory and Freestyle. Scoring for each is kept separate, and you do not have to enter both to compete. By far the most popular is Compulsory—a set of 14 to 16 maneuvers grouped together to form a sequence. These sequences are changed yearly and often reflect the maneuvers flown by the full-scale International Aerobatic Club (IAC). Scoring is based on a perfect 10 for each maneuver, with downgrades for various mistakes. In Freestyle, pilots are encouraged to "strut their stuff." Anything goes during the 3-minute event, with scoring based on originality, harmony and rhythm, execution and versatility. Many mistake Freestyle for sport flying, but the true competitor quickly realizes that harmony and rhythm always win over mayhem and chaos.

IMAC's common appeal to the average Sunday flyer—as well as to the competitor—seems to stem from one thing: the airplane. I know when I made the decision to compete, I was steered toward pattern. I was already flying an Ultimate and wanted to learn, but information regarding pattern airplanes and kits is very hard to find. It took me months to locate the publication "K-Factor," which covers every aspect of pattern. When I began to study the prospects of competition, I found that the typical pattern plane looks much different than your typical scale airplane. The average pattern plane is very sleek and sexy, but I prefer something with a little more girth on its fuse; enter IMAC.

IMAC's rules regarding scale state that the plane's "percent of scale" is determined by its wingspan. Once the percent of scale is known, you can stretch the fuse up to 10 percent and

reduce the width as much as 20 percent from scale; this makes legal nearly every Ultimate and Extra kit sold at the hobby shop. Additionally, most of the legal scale airplanes flown at contests are off-the-shelf airplanes such as Goldberg Ultimates and Midwest Extras, which are easy to find. These scale planes really sparked my interest, and it was only natural that I competed with what I already had.

The most recent trend in IMAC seems to be the large-scale airplane. IMAC has no minimum aircraft size requirements, and for years, 1.20-size airplanes dominated the circuit. In fact, the 1.20-size airplane is still a very strong competitor at IMAC contests throughout the nation. Most folks who are interested in starting IMAC or who have transportation limitations outfit themselves well with a 1.20-size plane. But lately, the thrill of finessing a large-scale airplane through an aerobatic sequence seems to be the desired course. I must admit that I, too, have been bitten by this "big" bug.

I believe this trend has been fueled by the spectacular size of aircraft found at the Tournament of Champions. While it's unlikely that the average modeler will have the funds and support vehicle to sustain a 40-percent Extra, the 28- to 35-percent market perfectly fills the niche of size versus cost. Most kits in this range are not that expensive and don't require a semi-trailer to get to the field. There is also the age-old premise that "bigger flies better"; this has been debated by pilots and judges for years.

My contention is that you can win with *any* aircraft, big or small, as long as you practice. I proved that point by winning the 1997 Advanced NW Regional Championship with my YS 1.20NC-powered Extra 260. I flew against nothing smaller than a 30-percent Laser all year, but still came out on top. I do believe that bigger probably "presents" slightly better, but it's certainly not like night and day; more like dusk versus dawn … take your pick.

Now, if all of this information has captured your curiosity, you may be wondering how to get started in IMAC. My suggestion is to start with the compulsory sequences and work your way through some

Ed Rogala of Midwest Products poses with his Extra 300S. Guess what? It's built from a Midwest kit.

The author scratch-built this 28 percent Ultimate.

Randy Brown flies a Midwest Giles 202 in competition.

Left: 1997 IMAC Sportsman National Champion Mike Kuper with his 70-inch Ohio R/C Extra 300S. Right: here's Tom Smith's CAP 232, another of Midwest's popular line of IMAC-legal kits.

When shopping for an engine to power your large-scale airplane, your primary concern is the power to weight ratio. Two manufacturers who are concentrating on the IMAC market with this in mind are 3W* and Brison Aircraft*. Shown here is a Brison 2.4 on glow. The engine is supplied from Brison as a gas engine complete with ignition, or it can be converted to glow for you at no additional charge.

Hot IMAC engine setup!

An advantage of gas is that it is less expensive to run, but it puts out less power than glow, whereas glow means a lighter engine (because the ignition is gone), but it must carry more fuel. Sound like a Catch-22? It really isn't; the Brison 2.4 glow runs on methanol with 4 percent oil; no nitro. You can purchase methanol at a local racecar shop for only $3 to $4 a gallon. The 2.4 will fly approximately 12 minutes on a 16-ounce tank, bringing the cost and weight of glow for this engine clearly into the lead.

When does gas become more attractive? When you get to the engines with 3.7ci and above. On glow, engines this large have to carry too much methanol, and the additional wing loading isn't worth the extra power.

So, what's the hot prop in IMAC? Again, there are two popular choices among the IMAC competitors. One is the Bolly carbon fiber, and the other is the Menz* wood. The Bolly carbon is noticeably stiffer and holds its pitch truer during loading, but it has a sticker price that's twice that of the Menz and still requires a bit of tip-sanding to quiet the prop noise. The Menz has a very efficient airfoil and is lighter than the Bolly. You decide.

How to fly the Basic Sequence

Here are some tips and insights on how to begin flying IMAC. The beginning category is called "Basic." Basic is the first 10 maneuvers of the Sportsman sequence. Take a minute to review the 1998 sequence and follow along.

Start by entering into the wind, wings level. Call the box to the judges by saying, "In the box!"

1. Loop: fly to the center of the box (straight in front of you) and perform an inside loop. The loop should be symmetrical, centered and should end at the same place as you started it. Make the loop at least 100 feet in diameter, or it will present terribly. Exit straight and level and head to the end of the box for the next maneuver.

2. Hammerhead (also called a stall turn): from level flight, pull vertical and head straight up. Pull back on the power. As the plane approaches zero airspeed, apply full rudder in either direction to allow the plane to rotate around its center of gravity. After the plane rotates and begins heading downward, *slowly* release the rudder. Retrace your upward line and exit with the same radius as you entered. Exit straight and level and head to the center of the box for the next maneuver.

3. Two continuous rolls: before you reach the center, apply aileron to begin rolling. Your goal is to have the plane cross the center pole as you begin your second roll. As you watch your plane roll, feed down-elevator when inverted and up-elevator when upright to keep your plane from losing elevation. The roll rate is not important, but maintaining heading and elevation is. Note: these rolls are continuous and stopping anytime during the maneuver will earn you a zero! Exit straight and level and head to the end of the box for the next maneuver.

4. Immelmann: use the same technique as you used with a full loop, but immediately after executing the half loop, roll to upright without losing heading or elevation. Maintain this higher elevation and begin reducing throttle for your next maneuver.

5. Two-turn spin: as you approach the center pole, reduce throttle to idle and begin holding the nose up with your elevator. The pitch of the plane is not important as long as you don't gain altitude. Your goal is to have the plane stall right over the center pole. When the nose finally falls, begin applying full aileron and rudder in the same direction to induce a spin. The direction of the spin is not important. Just before you have completed two full revolutions, let go of the stick and recover heading straight down. After establishing your downline, pull level and exit. Head to the end of the box for the next maneuver.

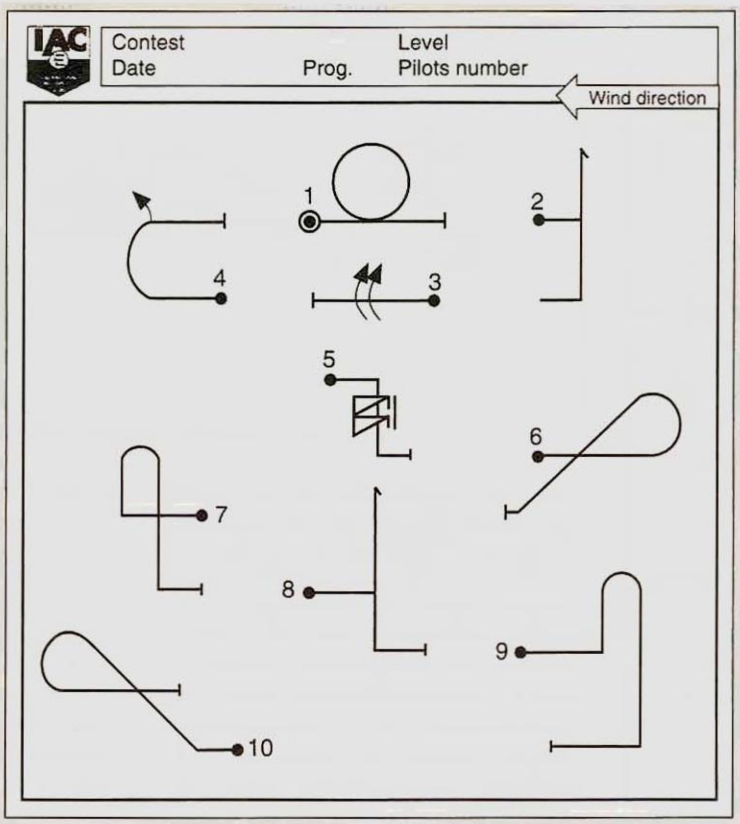
6. Half Cuban-8: as you approach the edge of the box, pull back on the stick

Mike Breen likes to fly big Extras in IMAC competition. In front is a Lanier Extra 300S, which he modified to a 300L; his Godfrey 300L is in the background.

very basic maneuvers.

Start by flying your plane out at a set distance of, say, 100 yards in front of you. At this distance, begin to fly parallel to the runway. Resist the temptation to bring the airplane back to you by banking left or right. Instead, use a turn-around maneuver like a hammerhead to retrace your aircraft's previous path in the opposite direction. Trying to keep the airplane at the 100-yard distance throughout your flight will serve two purposes. First, it will teach you how to control your aircraft before, during and

and perform $5/8$ of an inside loop. As you approach the $5/8$ mark, begin feeding in down-elevator to establish an inverted 45-degree downline; calculate how far it is to your entry altitude and roll upright when you are halfway there. As you approach your entry altitude, apply up-elevator to exit with the same radius as you drew during the loop portion. Maintain wings level and head to the other end of the box for the next maneuver.



7. Humpty Bump half roll down: as you approach the end of the box, pull vertical with a radius you can easily duplicate throughout the maneuver. Head straight up long enough to establish a vertical line, and perform a half loop at the top with the same radius as used to enter the maneuver. Don't forget to reduce throttle to idle before you pull over the top, or you will be screaming toward the ground. As you begin heading straight down, calculate at which altitude you'll want to exit, and perform a half roll when you are halfway there. Now end the maneuver with the same radius, heading back toward the center of the box, wings level.

8. Hammerhead, $1/4$ roll up, $1/4$ roll down: immediately before approaching the center pole, pull vertical with a gradual radius and head straight up. Decide how tall you want to make the maneuver, and when you are halfway there, roll the plane $1/4$ revolution. Note: you can roll in either direction, but the preferred method to make the maneuver easier is to be looking at the top of your airplane instead of the bottom. Now, cut the throttle as you approach the top of the maneuver, and perform a hammerhead as previously described. After the hammerhead, proceed straight down and $1/4$ roll in the opposite direction at exactly the same location as before. Continue straight down and exit with the same radius and altitude as you entered. Fly to the end of the box, wings level for the next maneuver.

9. Humpty Bump, half roll up: this is basically the same as the other Humpty, except you roll on the way up instead of on the way down. Be sure to keep the radiuses the same throughout the maneuver. Head to the end of the box, wings level for the next maneuver.

10. Half Reverse Cuban-8: way before you approach the end of the box, pull the plane to a 45-degree upline and decide how high you want to make the maneuver. Hold the 45; when you are halfway to the top of the maneuver, roll to inverted, apply a little down-elevator to maintain the 45-degree line and continue upward. When you have reached the top, reduce the throttle and begin your $5/8$ inside loop. Begin with a radius that will ensure that you end up at the altitude where you started. End the maneuver with wings level and call, "Out of the box!"

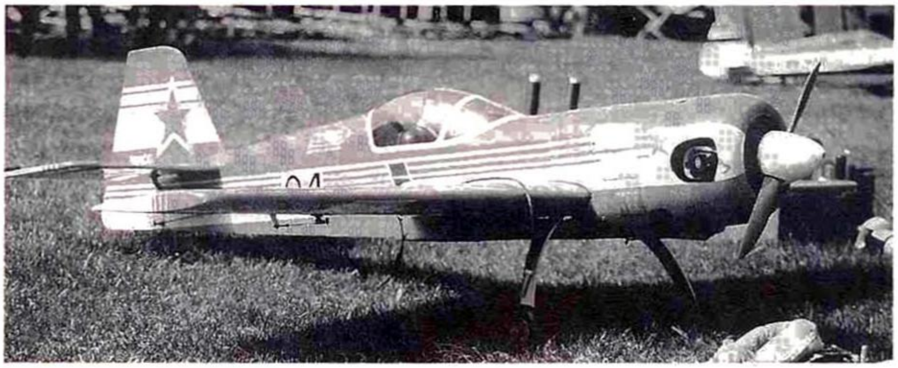
You have just completed the 1998 Basic Sequence. Congratulations!

after an aerobatic maneuver, thus making you a better pilot. After all, banging on the sticks and letting the airplane decide the outcome is not IMAC flying; it's sport flying. Second, it will teach you how to recognize and maintain the foundation of every IMAC flying maneuver: straight and level flight. Once you have recognized what straight and level flight looks like (notice I didn't say "master it"; after five years in IMAC, I'm still trying to master it), it's time to think about doing a few center maneuvers.

This 30 percent Pirate Extra 260 was built by Doug Fox.

Pick out a section of three to four maneuvers from the IMAC Aresti sequence that you feel confident you can complete, in succession and within a 150-degree box. Don't worry if it is in the middle of the program; just start where you feel comfortable and confident. Keep in mind that it won't be easy at all, and it may even be a little scary. Now fly these maneuvers as well as you possibly can. Remember, you don't get a free pass between the maneuvers; you must fly one after another. Try to keep the plane straight and level between each maneuver and throttle back! The biggest mistake made by newcomers is forgetting to throttle back. A properly flown sequence will *not* be done at full throttle but will require a lot of throttle management throughout the program. Also, be sure to keep your plane at about 100 yards out during the entire sequence.

The other mistake new flyers commonly make is to fly on top of themselves, as when you sport fly. This will get you in trouble in a hurry by shrinking your box so small that you will feel rushed and out of



The Sukhoi is another popular IMAC scale model.

sync. Once you feel like you can perform your chosen segment well, start tacking on the maneuver before and after as shown on the Aresti. In time, you will find yourself stringing together the entire sequence and looking ahead toward your first contest. I think you will also find a new direction and focus to your trips to the field, besides boring holes in the sky. A well-performed sequence will give you a sense of accomplishment that you probably haven't felt since your first solo flight. I would suggest, however, that you attend a local IMAC contest before entering. This will give you an idea of what the judges are looking for and which areas to improve. It's best to teach yourself the right way from the start instead of breaking bad habits later. Additionally, you will see how a contest is run *before* you throw yourself into the arena.

Finding out where contests are held and whom to contact is a matter of knowing where to look. The quickest way to find out about activity in your area is to visit the IMAC Web page at www.mini-iac.com. The Web page contains the current sequences, maneuver descriptions and regional director contacts. You may also sign up for an IMAC mail list, which is probably the best channel of information IMAC has to offer. Many manufacturers, TOC pilots and IMAC officers lurk on this list, so if you have any questions, you will undoubtedly receive an answer. Additional information can be obtained by joining IMAC. For a mere $20 a year, you'll receive four newsletters that are packed with flying, building and setup tips from seasoned veterans. You will also get news from around the nation and the latest policies concerning IMAC. To join, send $20 to IMAC's secretary: Dave Arndt, 2903 Forest Ln., Lorain, OH 44053-1554.

Coming full circle and answering the question, "Is it the airplane or the thrill of competition that makes IMAC so hot?" really depends on who you ask. Most Sunday flyers are content to know that the exact plane they are flying can aggressively compete and win in the IMAC arena; others have to prove it to themselves. In the end, though, it really doesn't matter what excites you about IMAC ... as long as you have fun doing it!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

What would scale aerobatics competition be without the venerable Pitts Special?

Groundwork for aerial success

MODEL AIRPLANE NEWS HOW TO

Multi-Engine Setup Techniques

by GREG HAHN

BUILDING AND FLYING multi-engine models have always been considered quite daunting, both mechanically and financially. But with the advent of gas engines and computer radio equipment, the initial setup and reliability problems aren't quite the Achilles' heel they once were. Through letters, phone conversations and discussions at fly-ins and competitive meets, I've come to realize that working knowledge about twins is pretty scarce. I remember reading a couple of good magazine pieces by Nick Ziroli Sr., in which he outlined some good, basic setups. But reprints aren't commonly available from periodicals, so you have to catch them the first time or be able to pick up a back issue. Otherwise, you're pretty much on your own.

WHY TWO IS BETTER THAN ONE

From a historical standpoint, the two basic reasons for having more than one engine on an airframe were safety, first, and speed, second. The safety theory is that if you have a problem with one engine, your aircraft will still be capable of flying to its destination and landing safely. In reality, that only works if you happen to be flying an empty plane that's low on fuel. To offset or absorb the added horsepower and weight of a second engine, the airframe moments and size must be increased to a point where the power to weight ratio essentially stays the same. So more often than not, maintaining altitude on one engine can be quite tricky, if not impossible—especially if the airplane is loaded near gross and the weather is hot and humid (high-density altitude).

Greg Hahn's D-18 is a Ziroli design.

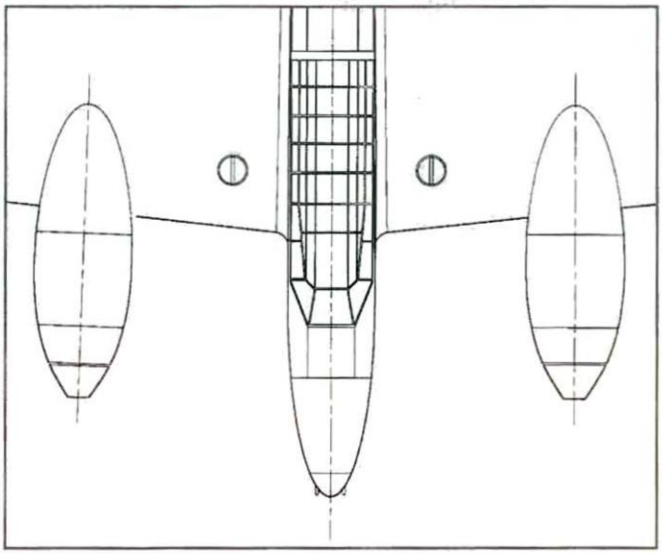


Figure 1. The rule of thumb for clockwise rotation (as viewed from the cockpit) is: 0 on the left engine, and 2 to 3 degrees right thrust on the right engine.

The speed reason definitely holds true, though. When you have more than one engine turning, you have more speed. As I mentioned earlier, the power to weight ratio essentially stays the same, but you obtain more speed and climb performance from two, three, or four engines than you would from a single.

What I'm trying to get across here is that you get more speed (thrust) from two 1,000hp engines than from one 2,000hp engine bolted to the same airframe. The easiest explanation involves prop "disc" area, or what I like to call lift area, since propellers are actually rotating wings. The geometric formula for the area of a circle is 3.14 x diameter. Let's say that a 2,000hp engine will turn a 3-blade prop 14 feet in diameter, and a 1,000hp engine will turn a 3-blade prop that's only 11 feet in diameter. The "disc areas" are 43.96 square feet and 34.54 square feet, respectively. So our two 1,000hp engines are turning a total disc area of 69.08 square feet, as compared to the single 2,000hp engine's disc area of 43.96 square feet. Therefore, our twin-engine airplane has the ability to produce around 50 percent more thrust from the same horsepower. There's a lot more involved, but I hope you get the idea.

IS THERE AN "EASY" MULTI?

Of course, the question most often asked is, "What would be a good multi-engine trainer?" Well, to be honest, there's no such thing as a good multi trainer. Most available multis, in either plans or kit form, are of the "scale" variety, which usually means they look like a real airplane and the wings aren't held on by rubber bands. Back in WW II, the Army Air Corps needed a good multi trainer, but it was expensive and they couldn't justify the cost for an airplane that neither produced bullet holes nor bombed factories.

I guess the same scenario holds true in modeling; it would be awfully hard to justify the time, energy and expense to hang two or more engines on a Big Stick—especially when doing so might change the flight characteristics enough to transform an otherwise nice-flying sport plane into an ill-handling monster. So what we're looking for is a good "first" multi, keeping in mind that all multis are complex, high-performance aircraft and therefore, not "easy."

Of the available kits and plans, my choice for a first multi-engine is the Douglas DC-3/C-47 transport, developed in the 1930s as an early airliner. The Douglas designers were able to incorporate all the available technologies of the day into an airframe that was truly multipurpose. Probably the most important of its many mild-mannered design attributes is the proximity of the engines to the centerline. This lessens the effect of adverse yaw if an engine failure occurs in flight.

Some of its other goodies are a big, thick wing, long tail moment and rugged gear arrangement. Touting the C-47 as a good "first" is easy, since it was my initial entry into the world of multiple discs. I chose Nick Ziroli's design for its size and because I was familiar with his plans. (When you delve into something new, it's always good if some of it is familiar.) If size is a problem, Royal also puts out a kit for the C-47, and I believe it's designed for a pair of .20- to .40-size glow engines and has 80 inches of wingspan. Both models are time-proven great performers. For me, the C-47 proved to be a great choice; I learned many lessons, and the plane survived the bumps and grinds.

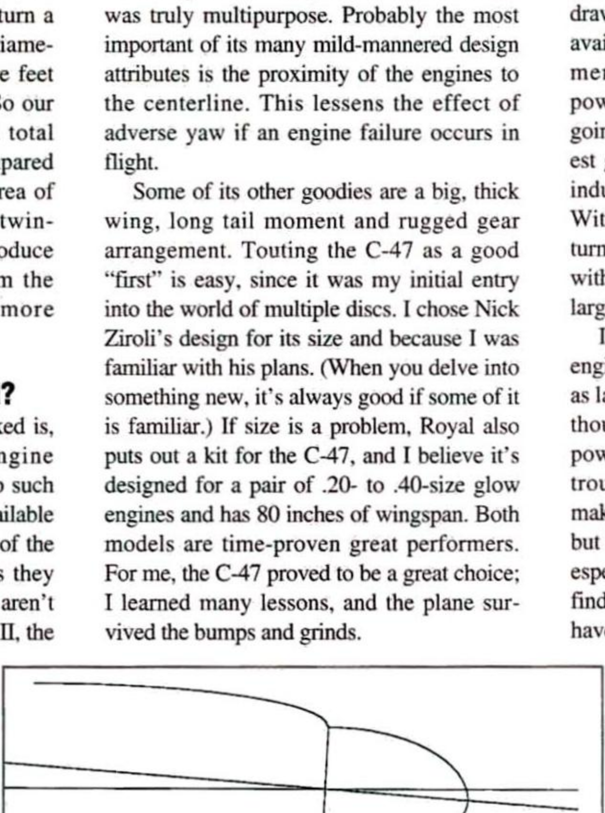


Figure 2. To offset pitch sensitivity to throttle changes, downthrust should be built in 2 degrees negative on both engines.

BIGGER CAN BE BETTER

One of the reasons for going with Nick's design was its physical size. The plane is large enough to accept gas engines, which I have advocated for many years because of their reliability and lower fuel cost. The only drawbacks are their weight and limited size availability at the lower end of the displacement spectrum, which is why all gas-powered multis are quite large. If you're going to run gas, it has to be big. The smallest gas burner available now (other than an industrial conversion) is the Zenoah G-23. With a 23cc displacement, the engine will turn a 16x10 2-blade or 15x8 3-blade prop with ease. A pair of these coupled to Nick's large C-47 works very nicely together.

I've also seen this model powered by engines as small as O.S. 1.08s on glow and as large as Zenoah G-38s. Engines this large, though, seem to be a bit much, and overpowering a twin can get you into a lot of trouble in a hurry. Too much power can make any airplane tricky to get into the air, but in twins it can be downright disastrous—especially if you lose an engine in flight and find out that the vertical fin and rudder don't have enough side area or throw to hold the model straight!

If you're going to run glow engines, reliability should be the top priority. I'll give you a few things to keep in mind: avoid inverted mounting; 90 degrees is probably the best. It's not quite as pretty, but you can be more flexible in your tank arrangement, and the carb won't flood as easily at low throttle. An upright engine is also 100 times easier to start. Use the biggest-diameter props your engines will handle and mild

The Douglas DC-3/C-47 is a good choice for a first multi. This one is a Ziroli design.

(nitro) fuel; this will help control overheating. The bigger the prop, the better the idle! Use a glow driver if you feel there is a need, and set it to come on at 1/3 throttle and below. It never hurts to keep "fire in the hole." Use good-quality engines that you are very familiar with (you don't want to have to learn new engines, too!).

SET UP FOR SUCCESS

Whether you're building, flying, hauling, or whatever, the better the setup, the better the outcome. If you follow a good setup procedure, you probably won't encounter any big problems when you go to the field. Pilots of full-scale multis have quite a few more tools at their disposal than we do in our models. Many times, I could have used individual throttle controls or individual brakes. Even though these could be easily accomplished, manipulating the controls would be difficult at best, considering I only have two hands. But with my two hands, I can build in things to help make up for the control deficiencies inherent in modeling.

Offsets and thrust lines are usually design issues, but I am asked about them quite often—usually, "How much?" and "Where?," or "Is the designer right?" If you're building from a good set of plans or a kit, the engine offsets have already been drawn in to counteract bad tendencies or just to make the plane handle a little better in the air and on the ground. If you want to check them out, or maybe try some designing yourself, the rule of thumb for clockwise rotation (as viewed from the cockpit) is: 0 on the left engine and 2 to 3 degrees right thrust on the right engine (see Figure 1). Engine offset is even built in on full-scale aircraft to counteract the compound effect of "P" factor and rotational torque. Two degrees negative downthrust should be built in on both engines to offset pitch sensitivity to throttle changes (see Figure 2). Designers sometimes accomplish downthrust using wing and horizontal tail incidences.

The *most important* aspect of any multi-engine setup is the throttle (servo to carburetor) linkage, so take your time and get it right! I recommend using a separate servo for each engine. Since today's servos have rotary output only, the amount of deflection lessens as the servo reaches its maximum travel in either direction; this makes the geometry of the linkage very critical. For the engines to run together accurately, the linkages must be the same length and tightness and should preferably make the same turns. I use Nyrods for my throttles because they can be bent easily enough to make the turns without binding, which is really important considering how tight small nacelles can be, and they eliminate the need for those dreaded bellcranks, which should be avoided at all costs. The only drawback to using them is their sensitivity to hot and cold weather. They will expand and contract with temperature changes, so keep the inner plastic rods the same length and they'll move the same distance without affecting your linkage geometry. Keep in mind that this movement will have an effect on your idle trim setting, so some adjustment to the travel volume on your throttle channel may be needed from time to time.

While building, take your time to get the throttle linkages right and the offsets where they're supposed to be. Don't go straight to the field on the first day; take it outside and get those carbs and needles set right.

LET'S TALK ENGINES

After you get the throttle linkages set up properly and the plane is complete, you're ready to run the engines. Whether you're running glow or gas, forget everything you know about turning needles and start fresh. The object here is to obtain reliability and synchronization, not every screaming ounce of power. Run the engines separately, and tune the low and high needles so that you have a good transition (idle through full without hesitation) and a solid high end but not too lean. Then start both engines and, with the aid of a tachometer, decide which one is stronger. (This is where most guys get into trouble, so listen up!) Leave the weaker engine alone and then slowly richen the stronger until it slows down and runs with the weak one. *Never* lean the weak one up to the strong one; this is what causes most single-engine emergency landings, which is what we absolutely do not want—especially on a test hop! Once you become confident with the settings, you'll realize that tuning twins isn't that difficult.

Another little item that comes up in conversation from time to time is the question of using soft mounts. This subject can, at times, be akin to talking politics or religion over a long neck at the Dew Drop Inn, but it does warrant some discussion. I like soft mounts and have always used them on single-engine aircraft, but I tried them a couple of times on twins and did not like them. First, the thrust lines and offsets usually designed into the nacelles are very important. Soft mounts allow the engines to twist and turn; this changes the offsets, eliminating or compounding some of the correction and making frequent trim changes necessary. Then there's vibration, which is supposed to be eliminated or lessened by the soft mounts. Soft mounts work great with a single engine attached to a single airframe. Putting two engines with soft mounts on one

The author's P-38 demonstrates the larger prop area that is available to twins.

airframe can set up a third set of harmonics between the engines, and this can become very violent and destructive. This situation can also make it difficult to synchronize the throttles. Case in point: I went through seven aileron servos on my twin Beech before I narrowed it down to a vibration problem (I also learned that Nick Ziroli's Beech-18 will fly and land safely "rudder only").

Everything else on the plane, e.g., control surfaces, landing gear and radio, is set up exactly the same as for a single engine, which brings us to the flying characteristics. Fortunately for today's pilots, most—if not all—aircraft have nose gear, and they're even steerable! But back in the days of Benny Goodman (WW II), very few planes had a nose gear, and if they did, they were not steerable. Since most of the scale kits and plans are from this era, ground handling can sometimes be a problem. I've often said that getting a twin tail-dragger off the ground is like trying to do ballet in football shoes: you'll eventually get the job done, but it won't be very pretty. All I can say here is "practice."

Getting back to something I touched on earlier about the dangers of over-powering twins, there's this thing called "VMC," which is short for "minimum controllable airspeed." Simply put, this is the slowest speed you can safely fly on one engine with power on. Since we don't have airspeed indicators on our transmitters (yet!), we have no way of knowing our airspeed until it's too late. Having extra horsepower up front requires you to react more quickly and makes the situation much more critical. In any case, your best bet with an engine-out emergency is to power down and look for a clean, soft spot and set the model's belly down, hopefully with minimum damage. A lot of guys will try to go around and make another pass, which means pulling the nose up and trying to gain altitude; this is almost always a bad move or, more often, their last move. It is *always* better to go in under control than out of control!

While building, take your time to get the throttle linkages right and the offsets where they're supposed to be. Don't go straight to the field on the first day; take it outside and get those carbs and needles set right. Then when you go to the field, you'll be confident in your equipment and you can concentrate on the test flight, not the test run. Most—if not all—of the hassles of multi-engine aircraft can be eliminated before you ever get to the field. Remember, the worst place to find out that you have a problem is in the air. First get it right on the ground! See you at briefing.

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MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

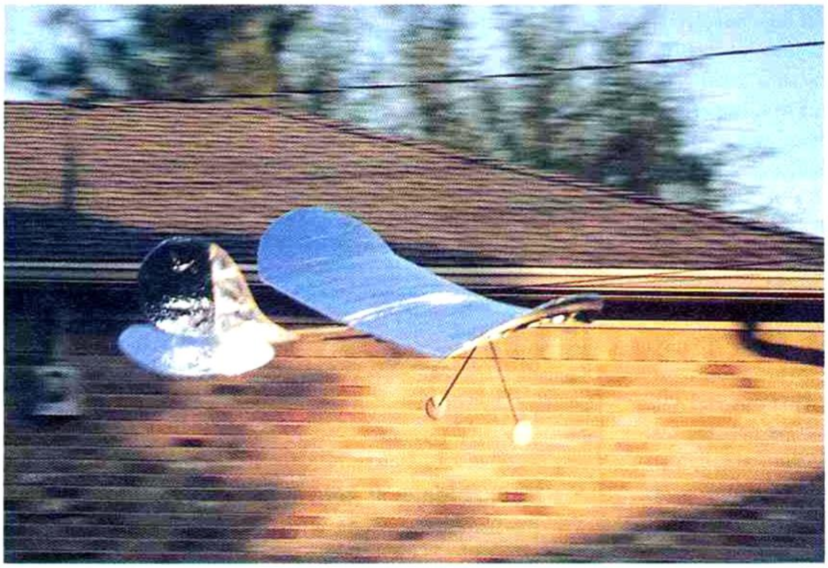
WHEN THEY USED to say, "And now for something a little different," on the old "Monty Python" show, they could have been referring to the Wespe, for it is definitely something different! This is an electric-powered, R/C airplane designed to fly slow and even indoors. When complete, its ready-to-fly weight is about 4 ounces. Top speed is near 4mph, and the model will cruise at less than that.

Clancy Aviation

Slow-flyin' Wespe fun

by RANDY RANDOLPH

The slow-flight movement started about three years ago in Europe, and it is well established in Germany, France and England. Model magazines from those countries feature slow-flying airplanes in almost every issue. The idea spread to this country about a year ago and has been growing ever since. One of the first to promote the concept of slow flying was Andy Clancy; in fact, he designed his Lazy Bee with just that thought in mind.



Clancy Aviation* is a source for just about anything in the slow-flight movement. It now imports the Wespe (wasp in German), which was designed especially for the WES-Technik power system and includes the geared motor, speed controller and servos. The Garrett receiver completes the airborne package and is, in itself, a work of art. The complete system—motor, gears, prop, speed controller/BEC, receiver and servos—has a total weight of well less than an ounce! This is not a "weak-sister" system at all; that motor takes this airplane by the nose and leads it in a merry chase. Without the controller, it would be a real handful. The servos have plenty of power to shove some rather large control surfaces around with authority so that control is positive.

The kit contains sheet wood, lightweight covering material, carbon-fiber tube and rod, balsa dowels of various sizes, beautiful light wheels, plans and instructions. The plans are in German, but the instructions are in English. It is a good idea to read the complete instruction booklet before you start the project because there will be some head-scratching during construction. The wing and tail surfaces are built right over the plan, and the fuselage is built from measurements; there are no templates or drawings of bulkheads. Since the instructions are not step by step, you can start wherever you like.

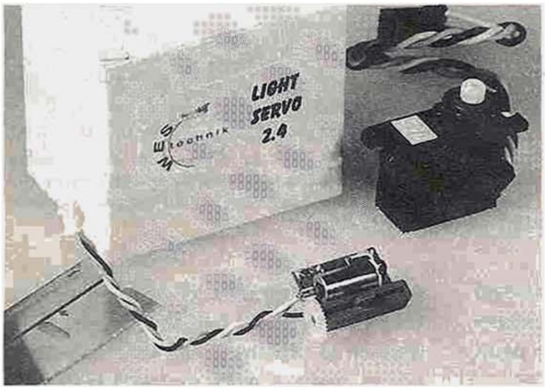
TO THE BUILDING BOARD

I started with the wing. The wing plan shows only the center section and one wing panel. I used an old trick and oiled the plans with a little vegetable oil so I could build the other wing panel on the back of the plan when the first was finished. Before I started the wing, I had to do some machine work. The leading and trailing edge (LE and TE) spars are balsa dowels. The LE is about $\frac{1}{4}$ inch in diameter and the TE near $\frac{7}{32}$. Because the wings are joined at the center with carbon-fiber rods that extend through the center section and into the spars of each wing, the center of the LE and TE spars must be

drilled to accept the rods. To be sure that the holes were centered and drilled down the center of each spar, I made a drilling fixture from a 3x4-inch block of pine 2 inches thick. I mounted the block in my drill-press vise and drilled two holes that matched the diameter of the spars (1/4 and 7/32 inch). I slipped the ends of the spars into the holes in the block, centered it over the center hole in the drill-press table (so the spars would extend through the table) and used a no. 55 drill to drill the spars.

You have to trace the rib section from the instruction sheet. Since the tops and bottoms of each rib are the same, I made a plastic template. Sixteen ribs are required, and it takes only 17 cuts! Instead of forming the wingtips by wetting them and bending them with a soldering iron, I laminated them from three thin strips using good ole Duco Household Cement. In fact, I built the whole airplane with that cement. I laminated the tail surfaces from two thin strips the same as the wingtip. It probably wasn't necessary, but I like to laminate that way because it is stable and stronger than a single piece that is bent to shape. Actually, the flying surfaces were fun to build, but if you haven't had any experience working with light, built-up wooden structures, you might want to practice on a Peanut kit or two before diving into the Wespe!

This is the powerhouse that drags the Wespe through the air. It weighs 13 grams. The motor and ball-bearing prop shaft are glued to separate soft balsa blocks that can be adjusted to provide a perfect fit for the spur on the motor and the gear on the shaft.



The WES-Tech servos weigh 2.4 ounces and have a proportional horizontal output. The S90 servo is not what one would call big, but it looks like 1/4 scale compared to the little WES-Tech!

When the fuselage was squared up, the motor and the two servos were mounted along with the receiver and motor controller. This turned out to be a good idea because there is very little room for fingers between the top of the fuselage and the wing mount once the motor is installed. The carbon-fiber tube that is the tail boom is glued through two drilled bulkheads at the back of the cabin. When the tail boom was in place, I ran the receiver antenna through it to get it out of the way. It worked so well, I just left it there!

The covering material is condenser Mylar and for a very light material is relatively easy to use. I used a Uhu glue stick for an adhesive, and it worked just fine. Although you need a very sharp blade to cut this material and it does tear easily, in a way, it is forgiving, since it can be lifted and worked to eliminate major wrinkles. It can be shrunk with heat, but I see no reason to risk warping the surfaces just to make them look a little smoother. Although hinges are provided in the kit, I used the covering material in the typical Z fashion to hinge the surfaces; again I used the glue stick for adhesive. It seemed like a good idea to glue the fin/rudder to the stab/elevator before mounting them to the tail boom. It also seemed like a good idea to attach the wing to the wing mount and jig it in place before gluing the wing mount to the plywood struts in the fuselage.

When that had been done, I glued the

What looks like a Chiclet with writing is really a 4-channel FM receiver. These receivers are handmade by Paul Garrett and are truly beautiful. The motor/gear drive is held in place in the fuselage with two 1/16-inch balsa dowels, which should shear in case of a missed approach. Note downthrust.

SPECIFICATIONS

Model name: Wespe

Manufacturer: WES-Technik (distributed by Clancy Aviation)

Type: slow flyer

Wingspan: 37 in.

Wing area: 360 sq. in.

Length: 27 in.

Weight: 4.1 oz.

Wing loading: 1.6 oz./sq. ft.

No. of channels req'd: 3

Motor: WES Micro DC 5-2, 4 (included)

Battery: 6, 110mAh cells

Prop: WES 8x4 carbon fiber (included)

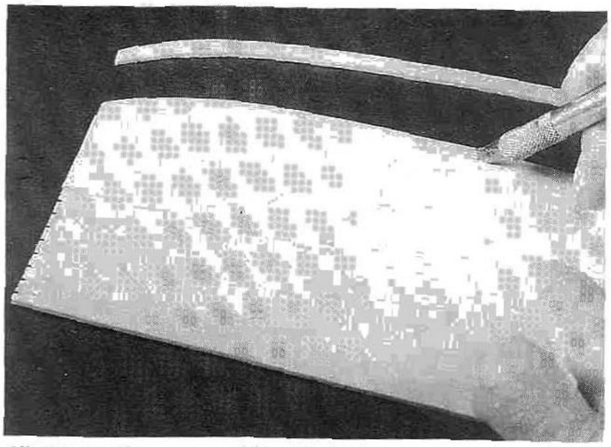
Price: $46

Features: this is a gentle, slow-flying airplane that can be flown in a gym or auditorium. It can also be flown outdoors when the wind is calm.

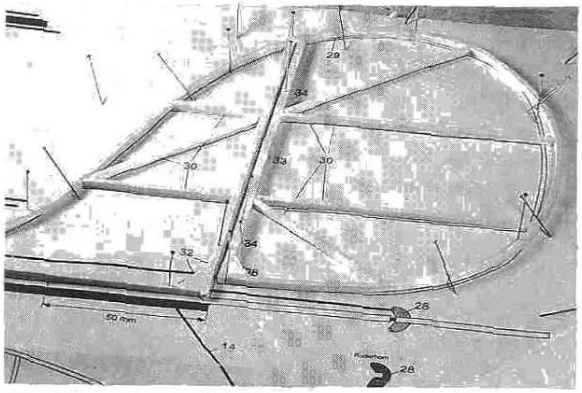
Comments: this airplane uses lightweight construction techniques that should be familiar to those who have some experience with small-model, stick-and-tissue construction.

Hits
- Excellent wood and carbon-fiber parts.
- Beautiful lightweight wheels.
- Well designed and engineered.

Misses
- Very little or no prefabrication.
- Multiple, small plan sheets are bothersome.
- Working from plan to parts list is somewhat clumsy.



All ribs are the same and are cut from sheet balsa by making a template of the top of the rib and using it to slice identical ribs simply by moving the template down each time. The guide marks on the bottom left of the sheet are $^3/_{16}$ inch apart, so each rib will be that width.

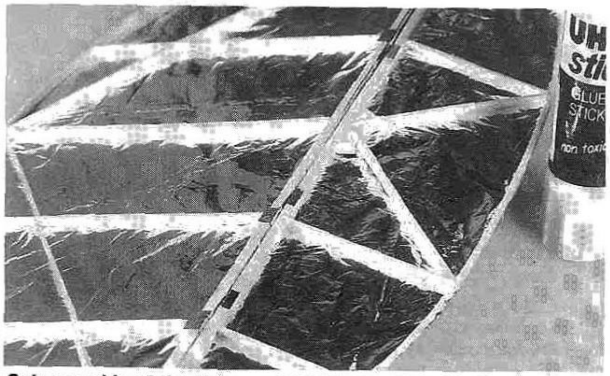


The flying surfaces are built right over the plan. The backing from MonoKote* is used to keep the glue from sticking to the plan. The entire airplane was built with model airplane cement (actually Duco Household Glue).

tail group to the tail boom while things were still jigged in place, and the results were well-aligned flying surfaces. Last came the landing gear and tail skid. I made up a 6-cell, 110mAh battery pack that fit perfectly in the area provided on the bottom of the fuselage. A trap door, hinged with Oracover*, held the battery in place. For a switch, I just plugged and unplugged the battery, which was fitted with Deans* connectors. Always be sure that the transmitter is on and working before you connect the battery pack! The airplane balanced at the point shown on the plan, which was a surprise!

LET'S HAVE SOME FUN!

The first flight was an ROG during an indoor contest, and the airplane was in the air before I was ready! There were some roller-coaster maneuvers while I was catching up, but after that, it became a pleasure. It did require some downtrim to fly nice and level at about ⅔ throttle. The reduced power was necessary to prevent it from running up to the ceiling all the time! This airplane will truly chase its tail! Turns of less than 6 feet in diameter are very easy, and if you really want, you can make it swap ends in sort of a snap turn. Touch-and-go's right at your feet are really fun, and you can fly it right up to your hand any time you want. Flying outdoors when the wind is calm is truly great! I fly in my backyard, which is a typical residential lot, and have no trouble at all. A typical flight is a hand-launch from the patio, under the TV cable, over the fence, under the power lines over my shop, touch-and-go on the driveway, back over the fence, around the apple tree and back to the patio. The 6-cell, 110mAh battery pack provides at least 10 minutes of this—actually, I think much longer—but I haven't pushed it. Quiet fall evenings will be a blast!



Only one side of the flying surfaces is covered with the condenser Mylar. The bottom of the elevator is shown so that the hinges, made from the same covering material, can be seen. They don't show at all from the top!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

GREAT PLANES

RealFlight R/C Simulator

by NICK ZIROLI SR.

MODERN COMPUTER technology has made flight-simulation systems a realistic training aid. I'm referring to full-scale aviation, where pilots can build flight time on the ground at a flight simulator. Military, commercial and private pilots all have simulators available for training. All the scenery and simulated motion are generated by computer.

I can recall, about 25 years ago while at Grumman Aerospace, being involved in a small way with a then state-of-the-art flight simulator. It did not use computer-generated scenery as is done today. The view from the cockpit was generated by a camera and projected onto a screen outside the cockpit windshield. The camera moved over a giant terrain map—a scale rendition with buildings, roads and all the details of the area to be flown over. This map was set up vertically against a large wall about two stories high. The camera traveled on what was similar to an X-Y plotting board that followed the pilot's inputs, and it changed speed over the terrain map according to the pilot's inputs. This was very exciting to see in operation; I was even lucky enough to fly it a number of times.

Today's powerful computers make all of this modeling and mechanics unnecessary. Scenery and motion are generated electronically, and the size of required computer hardware has been reduced drastically. The capacity of the computer I am writing this article on would have filled a large room—if not more—at that time, while today, the complete system sits before me on my desk. What's even more amazing are the wonderful, easy-to-use software programs that make it possible to put all this computer power to work for you.

We have the opportunity to put a home computer to good use, as the prices have come down to within reach of the average modeler. Flying via computer simulation is a practical means of accumulating flight time. I have owned the Dave Brown Products* simulator for many years. It is a versatile system that made good use of the power and speed of the computers available when it was introduced. I've spent many hours flying that simulator; it's still a very good system. Early simulators lacked realistic-looking models and scenery because of the computer's limited (by today's standards) capability.

Today's computers make the Great Planes* RealFlight R/C Simulator possible. The aircraft are so realistic, you can easily tell a P-51 from a Spacewalker. It's almost like looking at photographs of the nine airplanes available. In fact, the scenery is developed from photographs in what Great Planes calls "Photofield-3D Technology." You can choose five fields to operate from.

The system consists of a 6-channel controller in a Futaba transmitter case and a CD disc. This CD is said to be the equivalent of 130 floppy discs. For best performance, a state-of-the-art computer with Windows 95 installed is recom-

mended. RealFlight will run on an Intel Pentium at 90MHz and 12MB of RAM but you will not be able to use the high-resolution graphics; for that, you'll need a faster machine and at least 16MB of RAM. A Direct3D-compatible accelerated video card is also highly recommended. Before reviewing RealFlight, I upgraded my system and also added a 17-inch monitor, which I highly recommend. While waiting for the upgrade, I decided to get a second opinion on the installation and operation of the system. I knew my friend Bob Steele was eager to try a simulator, so while I was waiting, I gave it to him to get his input. I knew I would get some good feedback.

As are most Windows 95 programs, RealFlight is easy to install; just install the disc and follow the instructions. I had a problem calibrating the transmitter controls. No matter what I did, I got fluctuations of the control surfaces. Not until I removed my other game controllers did I get good calibration. Bob had no problems with the installation or calibration. The online instructions are very thorough and cover any problem that might arise, and the fix for my calibration difficulty was described in great detail.

Once RealFlight has been installed, you select "Simulator Settings" from the opening screen and other settings that will determine airplane characteristics, flying field, weather, etc. There is a very good sound system included with RealFlight that offers quite realistic recordings of actual engine sounds that match the engine being flown. Engine rpm follow the throttle setting precisely. This is in Doppler-corrected stereo that makes the model sound as if it is crossing the screen when it passes by. One feature that I did not care for was the crash sound effect. It was humorous the first few times, but after that, it was just annoying. Fortunately, this effect can be turned off. A choice of background music is available, as are other noises: crickets, field talk, etc. Jibes from your flying buddies pop up once in a while, such as "What did you cover that with" or "Bring it down where we can see it," or the classic "Does anyone have a glow plug?"

Calibrating the transmitter was a little confusing the first time, but follow the instructions and don't get ahead of yourself; the instructions are very complete. When the settings are correct, pick the "Select Airport" and "Airplane" buttons. The model choices run the gamut and include a PT-40 trainer, powered glider, Cessna trainer, Profile Extra, low-wing fun fly, Ultra Sport, Spacewalker, Ultimate bipe and P-51.

After you've made an airplane choice, pick a flying site. The scenery is developed from photographs of actual flying fields using RealFlight's Photofield-3D technology, and it is very realistic. Of the five fields available, I'm sure you'll find one that resembles yours. Along with the flying site, you have a choice of objects on the field, such as a building, people, trees, other airplanes and more. Some of the on-field objects' graphics, such as the trees, don't match the quality of the rest of the scenery. You can taxi or fly through any of the scenery. One of the features I have enjoyed with the Dave Brown simulator is the limbo poles and racing pylons; hit them and you crash.

When you have picked the flying site and model, click on the "Fly Now" option, and the screen will come up with your model sitting on the runway of the field you chose, engine idling, ready for takeoff. Power up, take off and fly. You

SPECIFICATIONS

Model: RealFlight R/C Simulator

Manufacturer: Great Planes Model Mfg. Co.

List price: $249.99 (simulator with Futaba controller); $169.99 (simulator software, CD disc only)

Features: extremely realistic scenery, model renderings and sound effects. Genuine Futaba transmitter controller. Easy to install and operate. Accurate flight performance. Over 200 variables allow you to customize airplanes, test changes, or create new design.

Comments: state-of-the-art computer simulations using actual photographs of five flying sites. Control inputs match the types of models being flown. Virtually any aspect of the nine included models can be re-configured to create new models. All-around great simulator. Requires Pentium P90 computer to take advantage of high-quality graphics.

Hits
- Easy installation.
- Realistic airplanes, scenery and sound.
- Ability to recreate models.
- Good online help.

Misses
- Not enough airfoil choices.

can reposition yourself from the flightline to the cockpit or in a chase plane at the touch of a function key. These keys, F1 to F12, are also used to zoom the model's view in or out. F7 will give you a view of the windsock.

Why the windsock? Well, you also have control of the environment: wind velocity, direction, turbulence and even thermal activity for the glider can be programmed in.

You will soon find that you are actually flying inside a diorama. Fly past the scenery, and you are flying outside your flying-field world. If you fly high enough, you can look down and actually see the field and diorama walls surrounding it below you. This takes nothing away from the normal functions of RealFlight; it's just interesting to see how it has been developed.

I was quite impressed with the accuracy of each model's performance. Each one flew as that particular type should. The trainers were docile, as they should be; aerobatic types were very maneuverable; and the P-51 flew like the heavy warbird that I am very familiar with.

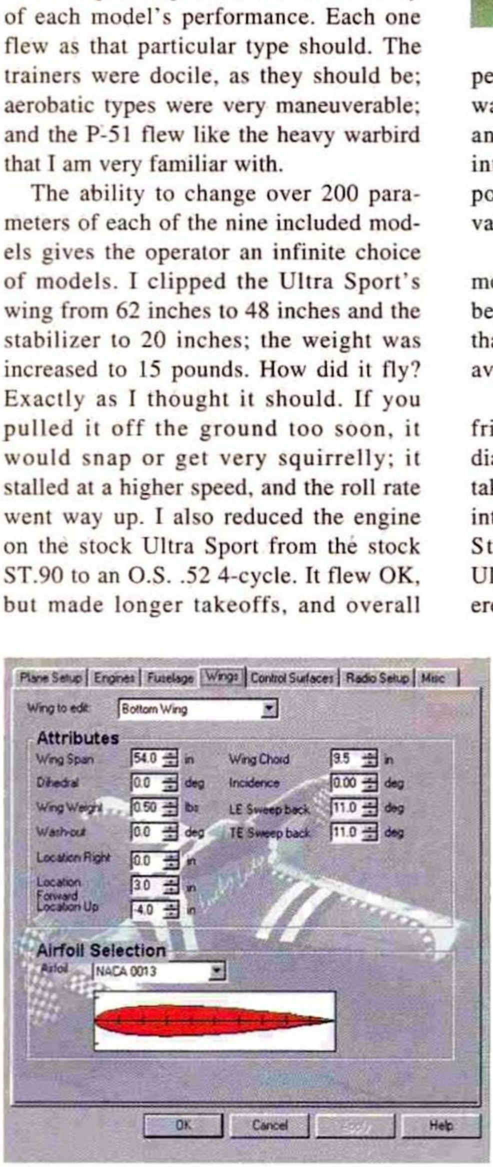
The ability to change over 200 parameters of each of the nine included models gives the operator an infinite choice of models. I clipped the Ultra Sport's wing from 62 inches to 48 inches and the stabilizer to 20 inches; the weight was increased to 15 pounds. How did it fly? Exactly as I thought it should. If you pulled it off the ground too soon, it would snap or get very squirrelly; it stalled at a higher speed, and the roll rate went way up. I also reduced the engine on the stock Ultra Sport from the stock ST.90 to an O.S. .52 4-cycle. It flew OK, but made longer takeoffs, and overall performance was degraded. The engine was then further reduced to an O.S. .40, and at that point, the plane would get into the air, but performance was very poor. For performance comparison, try various propellers on the engines.

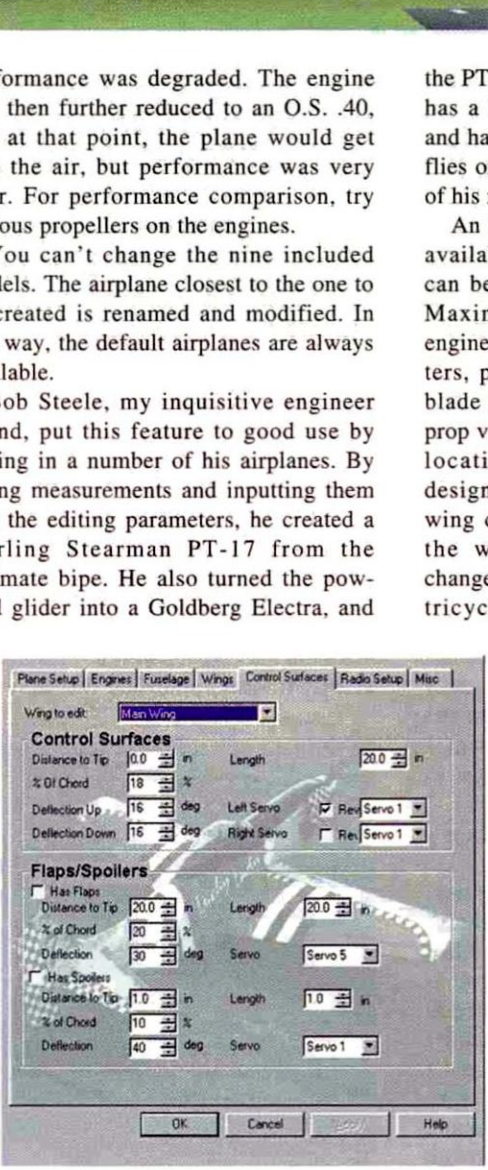
You can't change the nine included models. The airplane closest to the one to be created is renamed and modified. In that way, the default airplanes are always available.

Bob Steele, my inquisitive engineer friend, put this feature to good use by dialing in a number of his airplanes. By taking measurements and inputting them into the editing parameters, he created a Sterling Stearman PT-17 from the Ultimate bipe. He also turned the powered glider into a Goldberg Electra, and the PT-40 into an AirCore 40 trainer. Bob has a lot of flying time on the AirCore and has found that the one he created and flies on RealFlight is quite representative of his model.

An incredible number of variables are available for modification. The engine can be edited to a size of your choice. Maximum power and rpm of the new engine can be inputted. Propeller diameters, pitch, number of blades and even blade airfoil are some of the available prop variables. The engine thrust line and location can be altered for the new design; all aspects of the fuselage and wing can be modified. Airfoils on both the wing and tail surfaces can be changed, as well as the landing-gear type, tricycle or tail-dragger and location. Airfoils are available; three symmetrical and one flat-bottom. I often use variations of the NACA 2412 semisymmetrical airfoil on my designs, and I wish it had been included.

Much has been written about the value of a model flight simulator as a useful training aid. It is my opinion that yes, indeed, you can learn from a simulator. A person who can fly an R/C model will be able to fly the simulator. One who can't fly won't be able to, but he can learn. To demonstrate this, I left the RealFlight with my friend Daulton Sherman. Daulton is interested in airplanes but he is not a modeler.





Here are a couple of examples of the many dialog boxes available for custom designing an aircraft.

He and his wife visit our flying field often, just to watch the activities. I've let him take the transmitter of a trainer, and it was more than he could handle. He knew the basics, but orientation and coordination eluded him for the short time he had at the sticks. After a week with the RealFlight simulator, however, he could keep the PT-40 in the air for as long as he desired. He could make good landings, though not always on the runway. I've found it best, when landing, to use the "zoom" key, F3, to zoom out for a broader view of the model and the field. I'm going to see that Daulton gets some more time on RealFlight and then gets back to the field and has another try at the trainer. I bet it won't take much time to make him a pilot.

To sum up my opinion of the RealFlight simulator: it is outstanding. As a training aid, it has all the necessary maneuvering accuracy, realistic models, scenery and sound effects. Some parameters, such as twin engines, are not yet available. I would also like to see more airfoils available. Improvements and upgrades will be addressed in the future and, in all probability, will be available as downloads from the Internet at www.realflight.com. Congratulations to Great Planes for offering such a technically advanced system.

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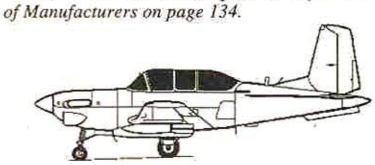


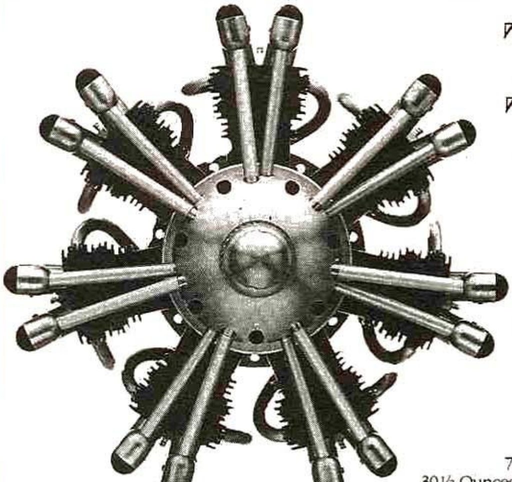
RealFlight Add-Ons, Volume One

While we were putting together this review, I got a press announcement for "RealFlight Add-Ons, Volume One." As Nick said, "Improvements and upgrades will be addressed in the future." Well, the future is now—and what a future it is.

This add-on disc provides 13 new airplanes, including a CAP 232, an F4U Corsair, a Learjet and an Aeromaster. There are seven new environments to fly in, including the "RealFlight University" campus, where you can fly through stadiums and such. You can fly over the Smoky Mountains, complete with the rugged terrain and elevation changes you would expect from this disc. You can even fly in a school playground, simulating some of the small-field flying many of you are doing these days. Heck, you can even fly on Mars, with scenery generated by NASA's Viking 3D images!

This disc let you change mountain shapes and add clouds and other atmospheric conditions; it includes more airfoils, too. It even has the NACA 2412 airfoil you wanted, Nick! All of this stuff is, of course, completely compatible with RealFlight. Surprisingly, this add-on disc sells for only $39.99 and should be available by the time you read this.

—LM



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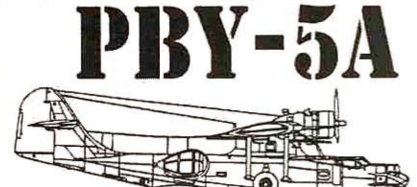

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PHOTO BY ROY DAY

You can bet the author's own-design Polish PZL-P38 balances perfectly!

Get the CG right

by ROY DAY

The key to properly balancing your model

THERE'S A LOT of truth to the old saying, "A nose-heavy airplane may fly poorly, but a tail-heavy airplane may fly only once." Correctly balancing a plane is very important; it is surprising how many crashes are the result of improper balance. You may be able to balance your forgiving, straight-wing (constant-chord) trainer on its spar using your fingertips, but a little more care is required for other configurations. This article will explain how to determine *where* the CG should be located, how to estimate the CG position *before* you position the model's components and, finally, how to confirm the final CG location.

DETERMINING MEAN AERODYNAMIC CHORD

The mean aerodynamic chord (MAC) for a straight wing is simply the chord of the wing. A good balance point for most configurations is about 25 percent of the MAC, measured back from the leading edge. This is often where the spar is and where the wing is the thickest. (That's why you can use your fingertips to balance that trainer on its spar.)

The MAC of a tapered wing can either be calculated or determined by a graphical method. Figure 1 is a typical tapered wing, where:

R = root chord (centerline chord)
T = tip chord

$$MAC = \frac{2/3(R^2 + RT + T^2)}{R + T}$$

Mark the calculated MAC on the wing outline where it just touches the leading and trailing edges. Now mark the 25 percent point on the MAC and project it to the root chord (R). Distance Y is how far the CG should be aft of the leading edge on the centerline of the root chord. Balance your plane at this point.

If you're uncomfortable calculating the MAC with the formula, here's a simple graphical procedure. Lay this out on your full-scale plans to get good accuracy. Extend the root chord (R) by the tip chord (T), both at the leading and trailing edges.

See Figure 2. Similarly, lay out the root chord (R) on the tip chord as indicated. Now connect these points with the diagonal lines as shown. The MAC is where the diagonals cross. Draw in the MAC and establish your 25 percent point as before. Project this point to the root chord (R); this is your desired CG (balance point).

HOW ABOUT BIPLANE WINGS?

In the case of biplanes, the "chord" becomes a combination of the top

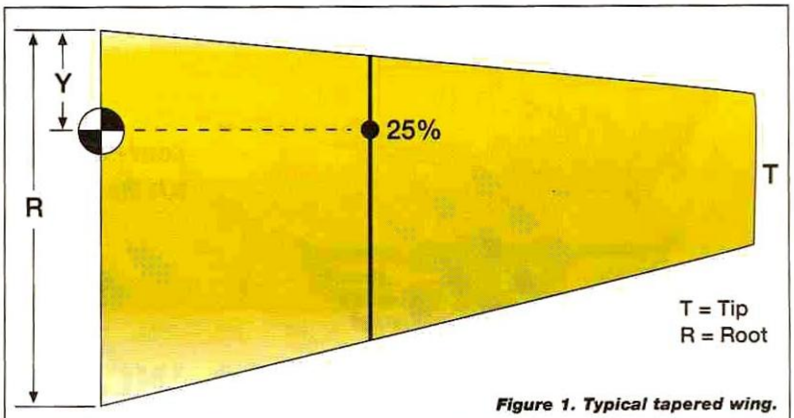


Figure 1. Typical tapered wing.

wing chord plus the stagger. Figures 3a and 3b illustrate how to determine the MAC for the two general classes of biplanes: straight wings with stagger and bent top wings with straight bottom wings. For top and bottom straight wings of equal chord, the effective "chord" is the chord of the top wing plus the stagger (Figure 3a). If there is no stagger, then the top wing chord is all you need to be concerned with, and this case is the same as for a monoplane.

For the case of a swept top wing and a straight bottom wing, use the graphical method as illustrated in Figure 3b and previously discussed.

BALANCING THE AIRPLANE

If at all possible, try to balance the airplane without adding ballast. This can usually be done if you make your preliminary balance check before you cover your airplane and before you finalize the installation of internal components. This preliminary check may indicate a location for the servos and/or battery that will require an access hatch. Even so, this is better than adding ballast weight.

If you're building a new design, or one in which the component layout is not specified or the CG position has not been noted, a calculation of the CG may be very helpful. To do this, you need to weigh all the components of the airplane and estimate their individual CG positions. The large structural pieces (wing, fuselage and tail) can be balanced on the scale as you weigh them. Dense components like the engine, servos and battery have their CGs at roughly the center of their side view. List all the components with their weights and their distances (moment arms) from a common datum line. This is illustrated in Figure 4 and Table 1.

CALCULATION OF CG

Component	Weight	Moment arm	Moment
Engine/prop	W_1	1_1	$W_1 \times 1_1$
Cowl	W_2	1_2	$W_2 \times 1_2$
Tank	W_3	1_3	$W_3 \times 1_3$
Main gear (etc.)	—	—	—

Total weight = W Total moment = M

The overall airplane CG position measured from the datum line is the sum of all the component moments divided by the total weight of the model.

$$L = \frac{M}{W} = \text{the distance of the CG from the datum line (Figure 4)}$$

Now, if the CG doesn't come out where

Figure 2. Graphical determination of MAC.

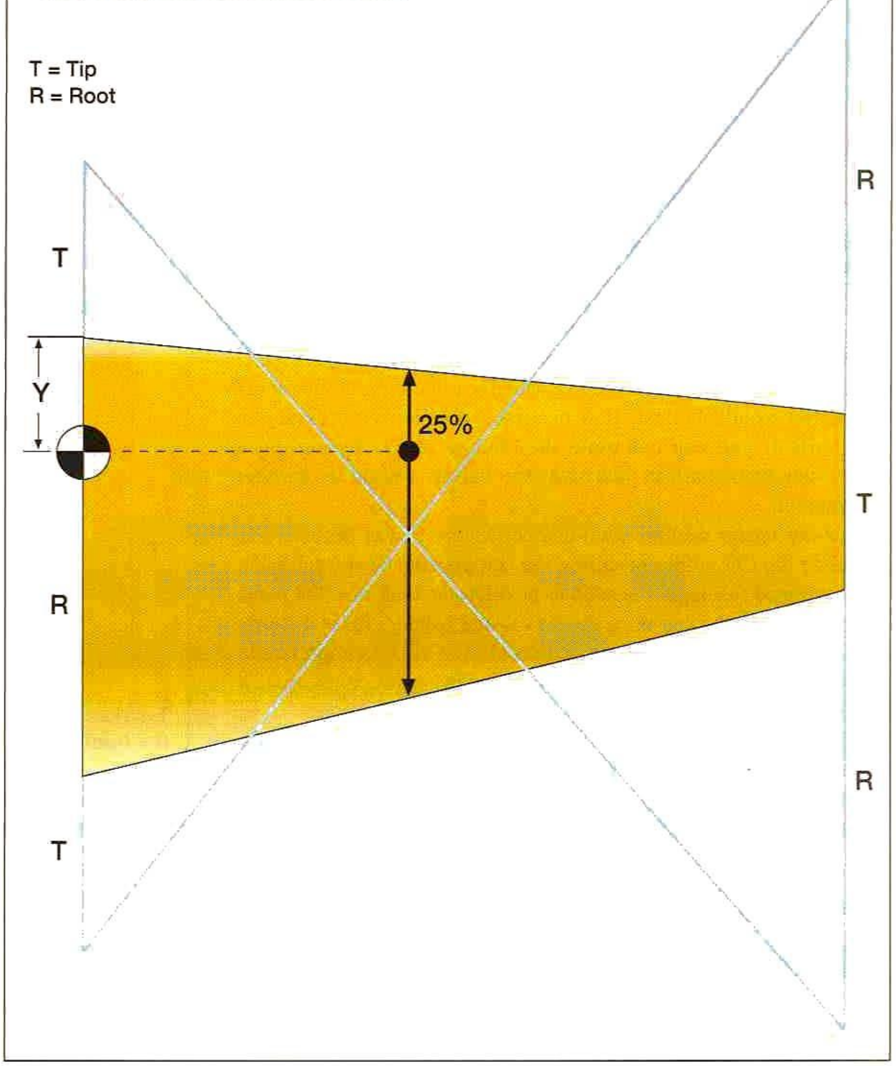


TABLE 1

Component	Weight (oz.)	Moment arm (in.)*	Moment (oz.-in.)
Props (2)	2	3.25	6.5
Engines (2)	30	5.25	157.5
Engine box (2)	1	7.75	7.75
Engine mounts (2)	2	7	14
Rudder/elevator servos	3	15	45
Aileron servo	1.5	14.25	21.4
Throttle servo	1	15.25	15.25
Receiver battery	3	10	30
Tank	2	12	24
Fuselage	8	17.25	138
Wing and landing gear	30	11.75	352.5
Tail assembly	4	41.75	167
Tail covering	2	41.75	83.5
Fuselage covering and sheeting	6	16	96
Wing covering	3	11.75	35.25
Tailwheel	1	40.5	40.5
TOTALS	99.5	270.5	1,234.15

$$L = \text{distance to CG from former F-1 (datum line)}^* = \frac{1234.15}{99.5} = 12.40 \text{ inches}$$

Example of calculation of CG for twin-engine airplane.

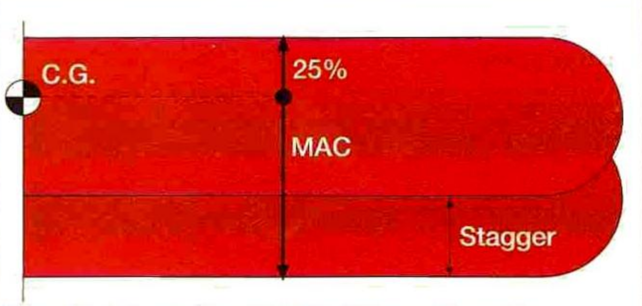
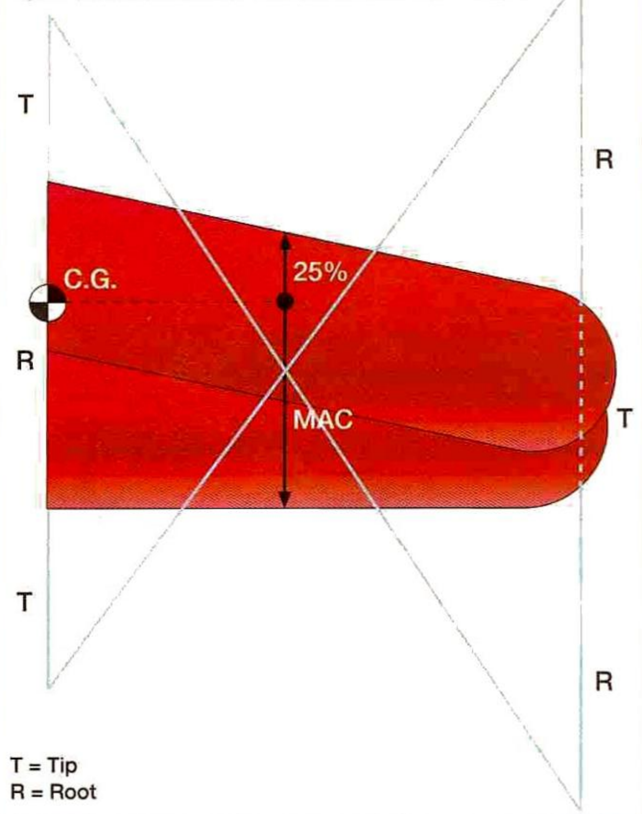


Figure 3a. Determination of MAC for biplanes with straight staggered wings.

Figure 3b. Determination of MAC for bent-wing biplanes.


you want it (on that 25 percent MAC point), you can reposition batteries and servos on paper and calculate the airplane CG again. This is a lot easier than physically relocating components or having to add ballast. If it becomes absolutely necessary to add ballast, you can calculate the change in CG by adding a given weight of ballast; just treat the ballast weight as another component.

For my recent original twin-engine design, it was necessary to calculate the CG before installing the components because it had a very cramped fuselage. I needed to position the tank near the plane CG and then find a space for the servos and battery. Table 2 shows my list of components and calculation of the CG. It is important to account for all items. Estimates have to be made for covering, if it has not already been applied.

Of course, calculating the CG must never replace actually balancing the airplane, but it is very useful for scratch-building—particularly if the configuration isn't standard. There are several methods for balancing your airplane, from suspending it to balancing it on supports under the wing. There's even a commercially available CG machine from Great Planes*. Use whichever method best suits you, but let balancing the airplane be one of your final checks before that first flight. Now that you know *where* the CG ought to be and how to determine where it actually *is*, you can expect that first flight to be successful.

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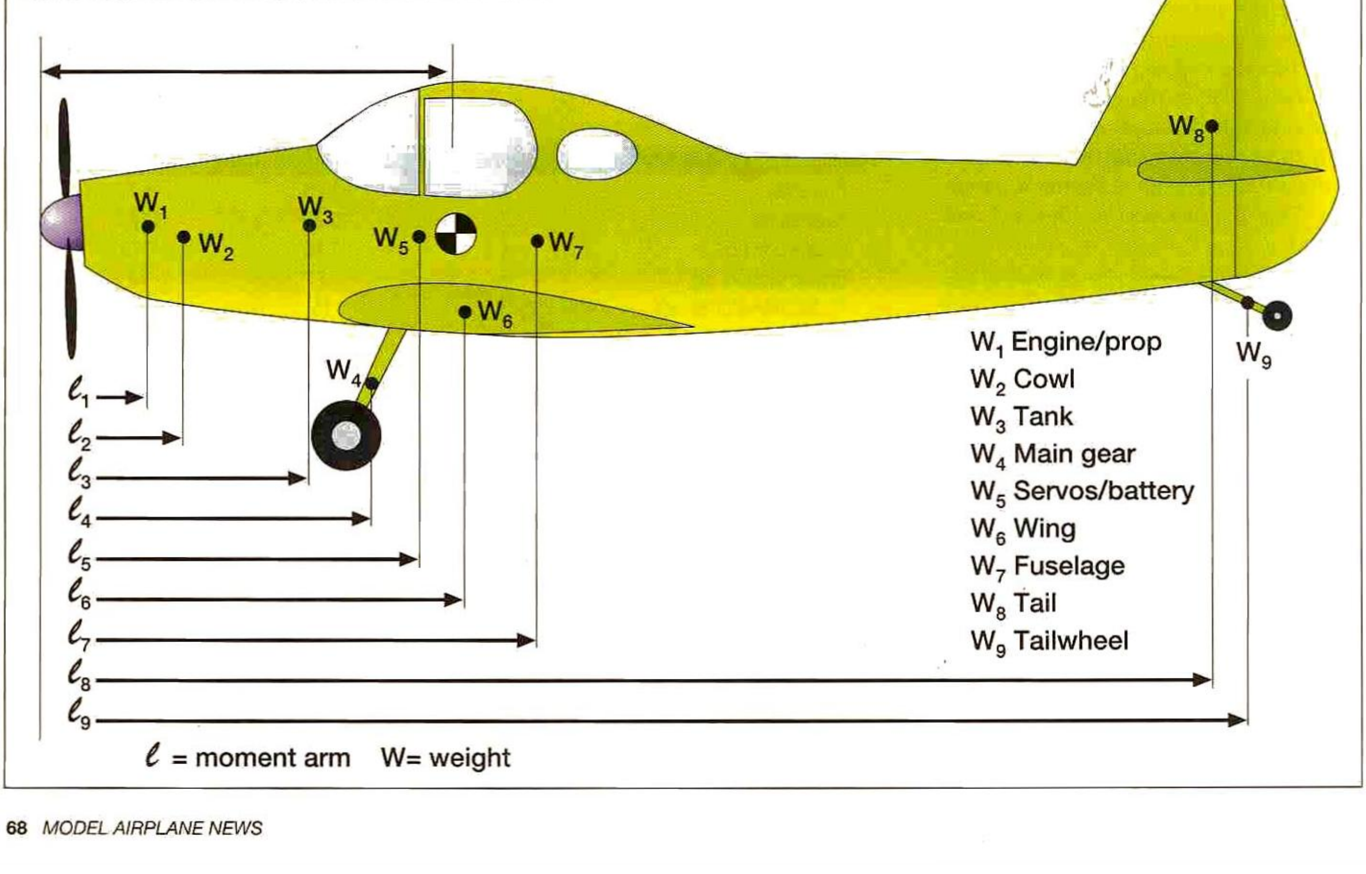
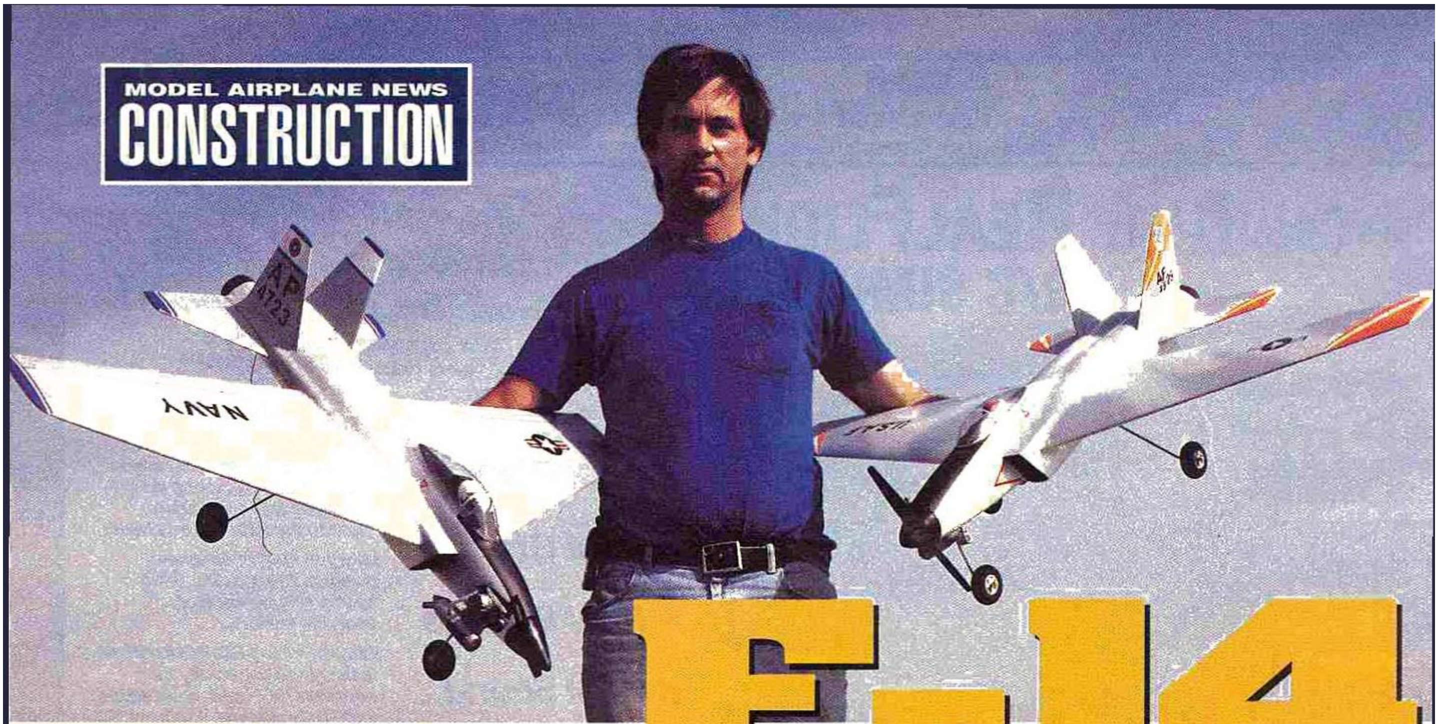
Figure 4. Typical layout of components for CG calculation.


MODEL AIRPLANE NEWS CONSTRUCTION



F-14 FOAMCAT

FOAM AND FIBERGLASS FIGHTER

by KEITH SPARKS

I WANTED A MODEL that looks like a jet but could be flown from a grass strip. This required a design that was smaller than most jet look-alikes and one with a light wing loading and easy ground handling. I enjoy scratch-building, so I decided to design a plane to meet my needs. I used Styrofoam to achieve the jet-like compound curves and made three prototypes. I improved the minor flaws each time and am now totally satisfied with the final product.

BEGINNING CONSTRUCTION

I began construction by photocopying the plans; that way, I have one copy to use as a production tool. One note on Styrofoam: I've used expanded bead (white) foam, and although it is light, it is difficult to work with when it's thin. The true (blue) Styrofoam is a little heavier, but it's much easier to work with; it's stronger, requires less filler and is available at builders' supply houses in 2-inch thicknesses.

To make heavier patterns, cut out the 15 section paper patterns, glue them to poster board and cut them out again. Trace the patterns onto the Styrofoam using a fine-point ink pen. Mark the centerlines and water lines as well. I use a felt-tip marker to number each section in its top right corner to help me keep track of which end is up. Cut the sections out on a scroll saw, using a fine blade to produce a smooth surface. Then cut "reference slots" approximately 1/16 inch deep on each end of the centerline and water line. (Be sure your saw is square before you cut the slots.)

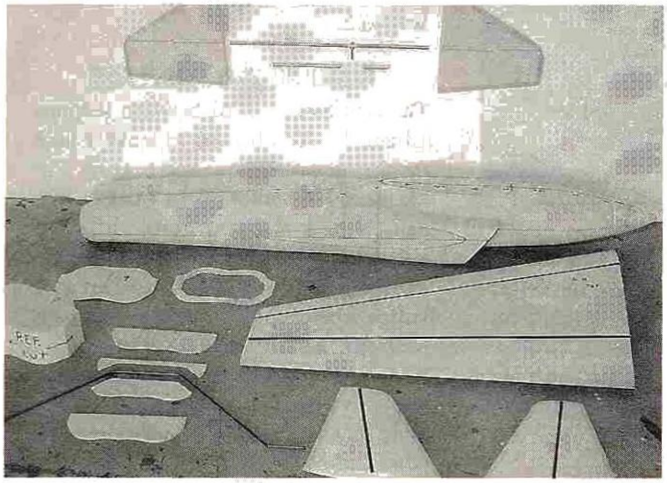
Using the reference slots as guides, temporarily bond the sections together with 5-minute epoxy. Two drops per section is enough to hold them together while you sand them. Sand the sides of the sections parallel to each other, and sand sections 3 through 7 flat to accept the Sig* canopy (part no. WC-809). Place the canopy on the fuselage, mark its position with a felt-tip pen, and set it aside for safekeeping.

PHOTOS BY KEITH SPARK

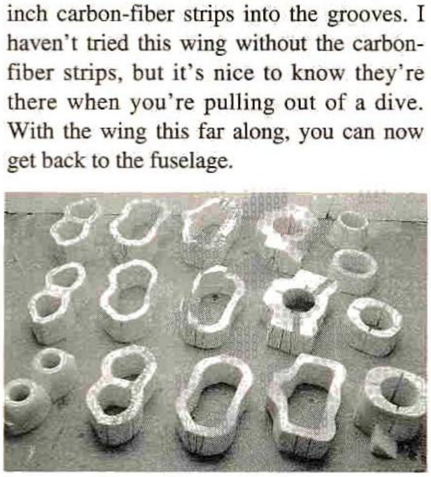
MAKING THE WING

The wing templates should be slightly oversize so you can later sand them down to create sharper corners and a smoother surface for the balsa strips to bond to.

Cut the basic shape out of 2-inch-thick Styrofoam. Now make Formica templates and attach them with double-side (carpet) tape. Cut the airfoil with a hot wire. The elevators and vertical stabilizers are identical at this point. Using a bar sander and 180-grit sandpaper, gently sand off any irregularities. The bond surface at the trailing edge (TE) is 1/4 inch constant. The leading edge (LE) tapers from 1/2 to 1/4 inch. Use 5-minute epoxy to bond the balsa to the Styrofoam, using masking tape to hold everything together while the glue sets, and then sand the balsa to the shape of the plans. Make a sanding block out of 1/8-inch balsa strip with 180-grit sandpaper attached to its edge with carpet tape. Using a straightedge as a guide, sand approximately 1/32-inch grooves into the wing and tail airfoils. Then epoxy 1/8-inch carbon-fiber strips into the grooves. I haven't tried this wing without the carbon-fiber strips, but it's nice to know they're there when you're pulling out of a dive. With the wing this far along, you can now get back to the fuselage.



The sanded fuselage is ready to be hollowed out.



The fuselage sections are ready to be bonded together.

COMPLETING THE FUSELAGE

Here are some tips for sanding the fuselage:

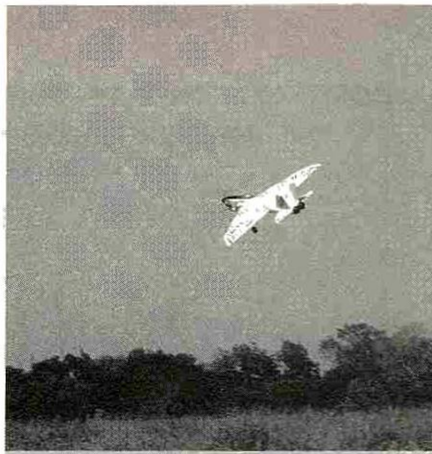
- Use 90-grit paper to sand off the corners using light pressure.
- Sand in short, 3-inch strokes until the sections blend together smoothly.
- In areas where the sandpaper gouges the foam, pull it across the surface by holding its corner with your thumb and index finger and apply light pressure to the rest.
- Final-sand with 180 grit following the same rules. Use bright light at an angle to spot and correct imperfections.

Using the wing halves as patterns, place them on the sides of the fuselage to align and mark the chord and fuselage centerlines. Wrap the spinner with carpet tape to avoid damaging it, and also use the tape to keep it on the nose while you sand. Then sand the fuselage, avoiding the areas marked for the canopy and wings. Leaving an area the width of the pen marks works well; leave the same amount around the spinner and fine-tune it later.

I separated the sections by gently bending the fuselage at the seams. If you start to dent the Styrofoam, stop and insert an automobile feeler gauge or something similar between the sections to loosen the bond.

To cut out the center of the section, drill a hole for the scroll-saw blade to pass through, put the blade in the saw and cut out the center.

- **Section 1.** Use a compass to mark the spinner side, and cut the wall to 5/16 inch



SPECIFICATIONS

Model: F-14 Foamjet

Type: fun-scale jet

Wingspan: 46 in.

Length: 35 in.

Area: 358 sq. in.

Weight: 3.5 lb.

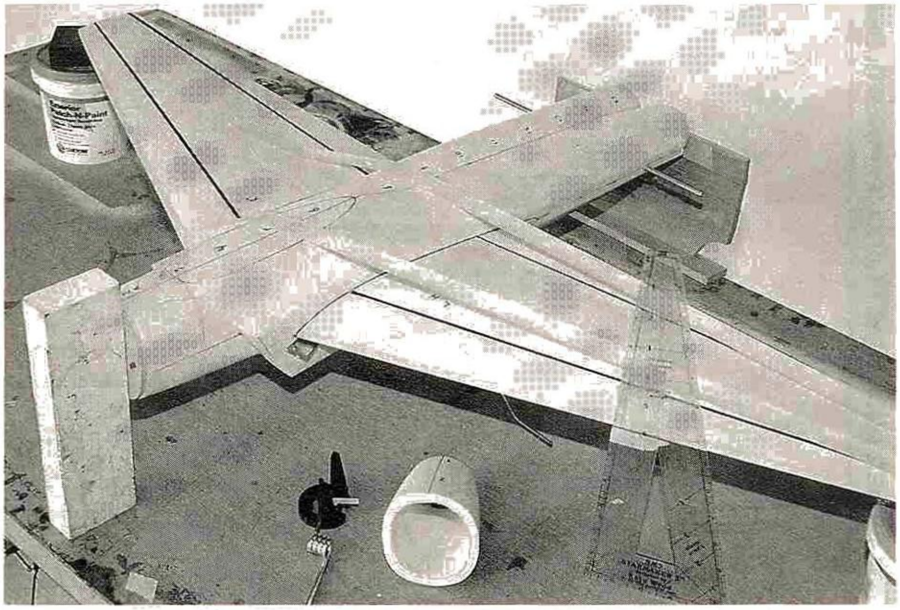
Radio req'd: 3-channel

Engine used: O.S. Max FP .25

Prop used: Master Airscrew* 9x4

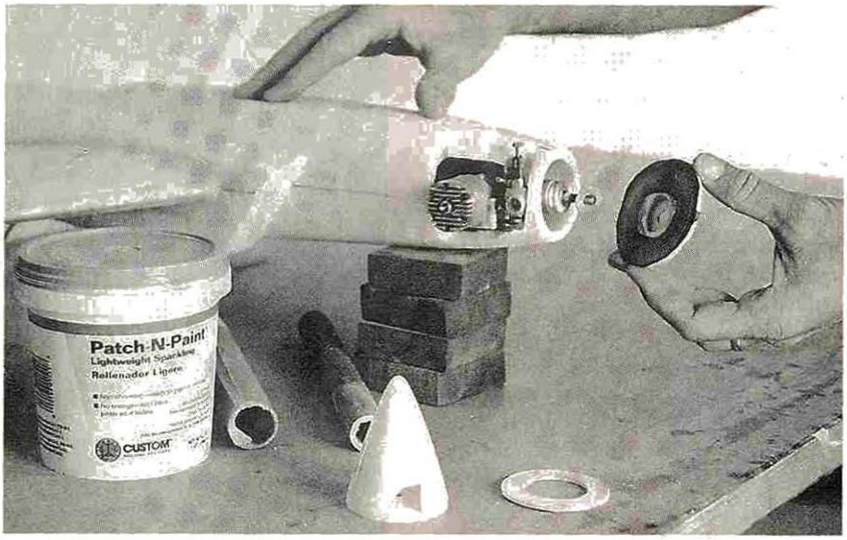
Features: glassed and sheeted foam construction.

Comments: this model is small enough to fit into a small car and requires no assembly at the field. It's a lot of fun to fly off a grass field and catches the attention of spectators.



The wings are bonded to the fuselage. The fuselage is held firmly in place with carpet tape while the wings are blocked up.

CONSTRUCTION: F-14 FOAMCAT



Using this special sanding tool will produce a perfect fuselage-to-spinner air gap.

thickness with the saw, use a scriber to mark the aft end, and sand the section down to the line using a tube with 90-grit sandpaper glued to it.

• **Section 2.** Cut off half of the aft end using a hot wire stretched ¼ inch high across the table. I made two passes. The most aft piece will be bonded to the front of section 2A; the next forward piece is disregarded, and the rest of the section should be finished the same way as in section 1.

• **Sections 2A through 5.** Use a compass to mark the holes, and when the corners have been removed, cut the nose stiffener slots. The aft end of section 5 should be marked with a scriber set at ½ inch high and then tapered to the line using the sanding tube.

• **Section 6.** Scribe and cut this section as before. Mine didn't require sanding.

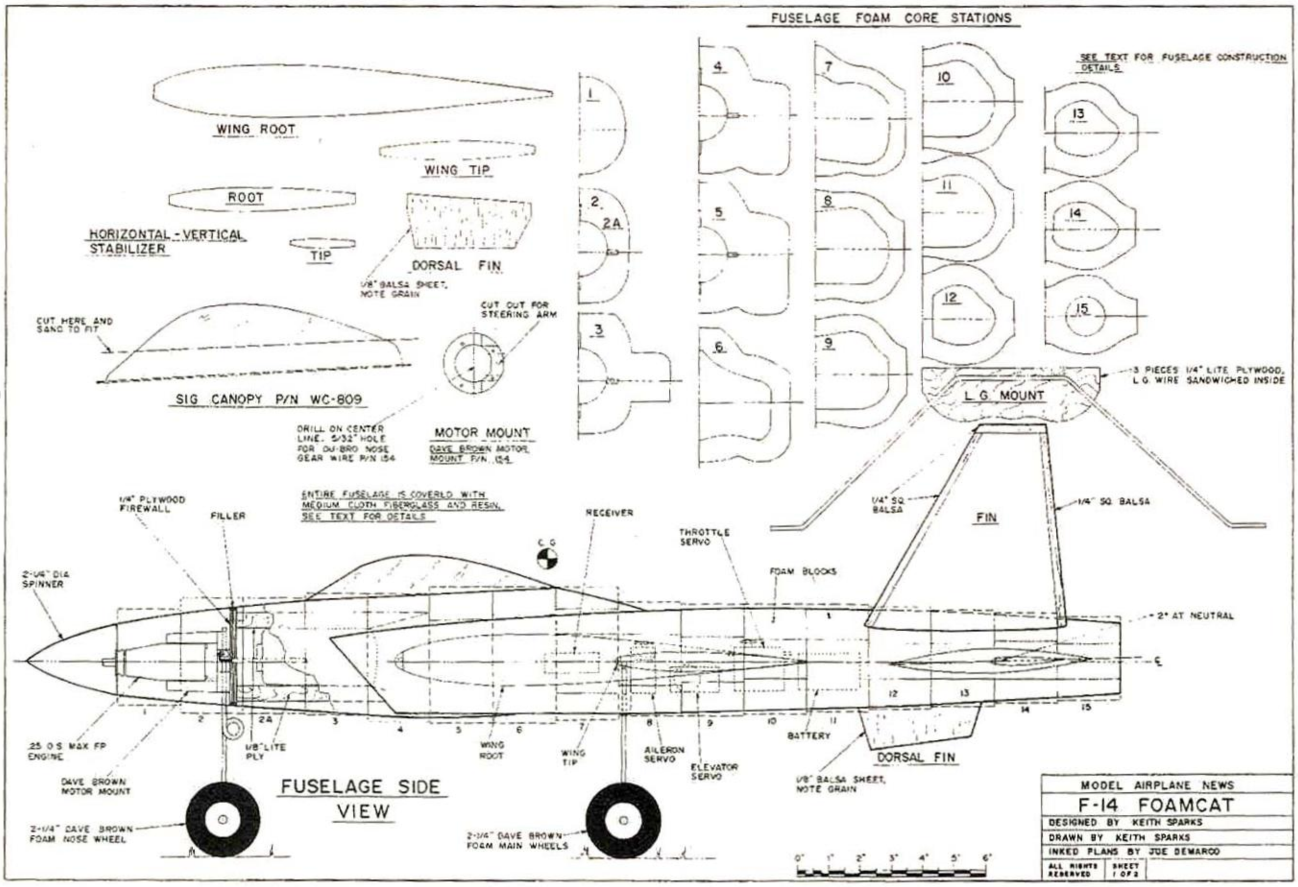
• **Section 7.** This section is scribed at ½ inch *only at its top back half* and then cut. The bottom half is used for landing gear support. The forward end of section 7 is scribed at ½ inch and tapered to the hole as in section 5.

• **Sections 8 through 15.** These are scribed at ½ inch. Make the bottom of the servo compartment (see patterns), then saw it out. Cut the front side of section 8 to accept the landing-gear plate in the same way as you cut off the rear of section 2.

BONDING THE FUSELAGE

The first bond will be between sections 13 and 14. You'll need to make a hole for the elevator torque-rod bearing. Put the aft end of section 13 on a flat surface and, using a sharpened piece of scrap aluminum tube, drill a hole through the centerline. When the brass elevator torque tube turns freely in the aluminum bearings, bond it in place with epoxy, then bond section 13 to 14. (Avoid using excessive epoxy! A thin film on the inner half of the skin is sufficient. The other half of the bond will be made during the fiberglass step.)

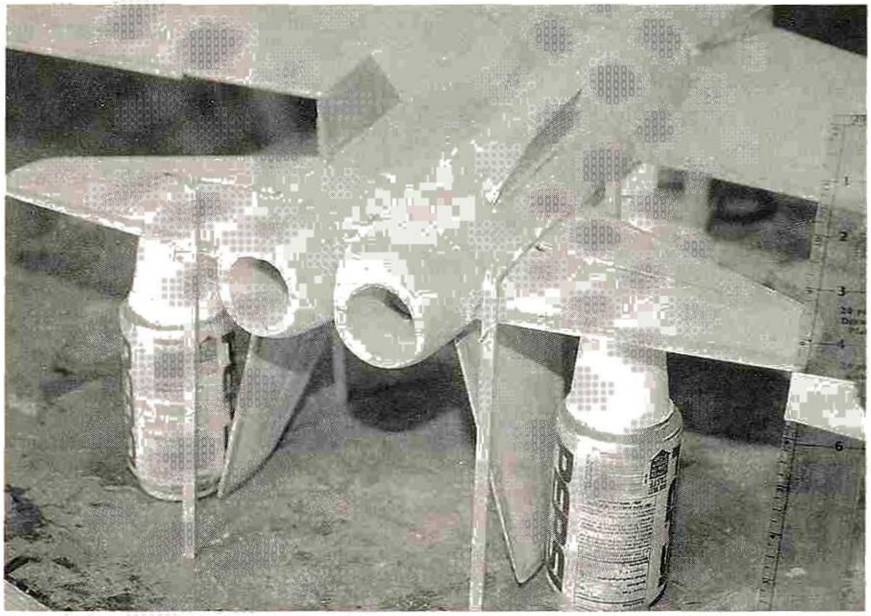
Sections 2 through 5 are next. After the bond has cured, install the lite-ply nose stiffeners. Trim the firewall approx-



TO ORDER FULL-SIZE PLANS (FSP09981), SEE PAGE 119.

imately $\frac{1}{16}$ inch smaller than the front of section 2A, then drill it and bond it into place. Be sure to install the blind nuts.

Now drill a $\frac{1}{2}$-inch-deep hole through the right-hand side of the landing-gear plate and the tapered portion of section 7. You'll be able to feed a servo wire through this. In section 9, drill a hole $\frac{1}{4}$ inch from the aft end at the centerline (as you did for the elevator torque tube). Now, force a prebent aileron torque rod and tube through the hole. Epoxy the tube in place using $\frac{1}{4}$-inch scrap balsa to prop up the end of the aileron torque rod while the aft end of section 9 sits flat on the table. The rest of the bonds are made one or two sections at a time until the fuselage is complete, with the exception of the section forward of the firewall. Use a razor to cut the TE of the wing $1\frac{1}{2}$ inches from its edge, then transfer the chord centerline to the back of the wing.

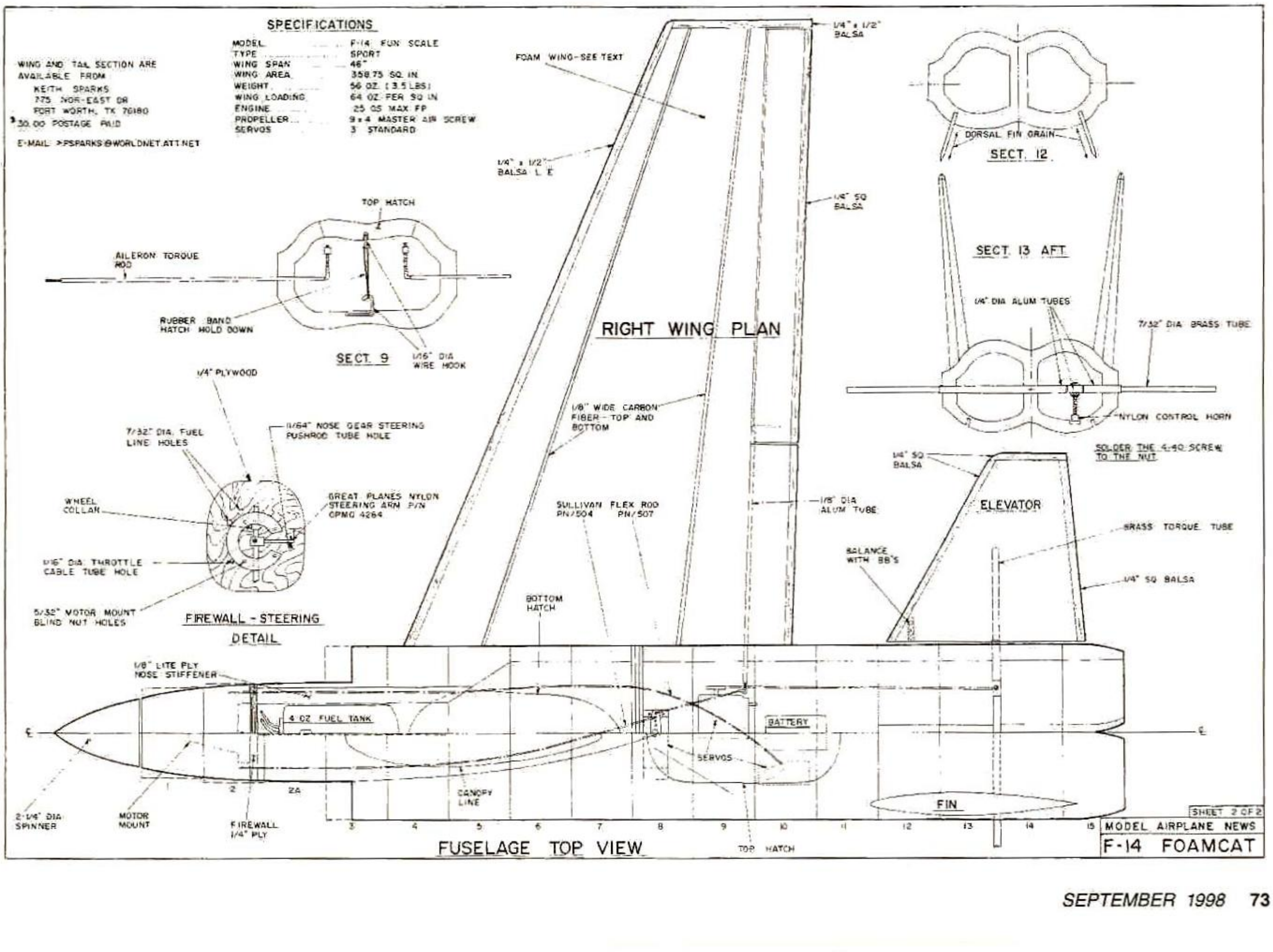


The elevators are being bonded to the torque rod. Careful alignment is required, so I used balsa sticks to make sure they didn't move.

ATTACHING THE WING

To prepare for the wing-to-fuselage bond, use the water line as a reference to make sure the fuselage is parallel to your workbench. To accomplish this, I used double-side tape to attach blocks to the firewall and aft end of section 15. Then I pushed three razorblades into the bottom wing-position line to support the wing. I test-fit the wing by placing it on the razorblades and pushing it against the aileron torque tubes. I also placed a block under the wingtip to keep the wing straight while the 30-minute epoxy cured. I used masking tape stretched just a little for clamping pressure. Be sure to wipe away any excess epoxy. Repeat this step for the other wing half.

To install the vertical stabilizers, sand them at an angle and test-fit them. When you're satisfied with the fit, draw a line along their chords and another line parallel to the fuselage centerline. Use toothpicks to make holes at the ends of each stabilizer's chord line. Break the toothpicks in half, and push them into the



The primer sealer has been applied; this step fills the glass weave and protects the foam from the paint.

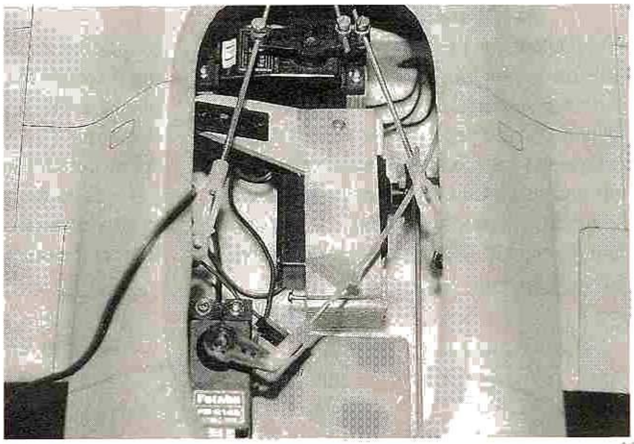
holes. This will keep the stab in place while the epoxy cures. Align the points of the toothpicks to the lines on the fuselage and push the stab into position. I used tape for clamping pressure and added a small spackle fillet around the base of the stabs.

Now install the Dave Brown* engine mount (part no. 15X) and bond sections 1 and 2 to the firewall. Use a Dremel* tool to cut away an area inside the cowl for the engine, in this case an O.S.* Max .25 FP. Use lightweight household spackle to fill the areas where the plywood is exposed and to fill the grooves for the carbon fiber rods. Spackle can also be used to fill any imperfections as well as to make fillets around the wings. Let the spackle dry overnight, then lightly sand the entire fuselage with 280-grit sandpaper. This is necessary because when you cut out the center of the sections, the foam's inner stresses were relieved and the sections changed shape slightly. This is why I only bond the inner half of the skin. If the epoxy seeps to the outer surface, bumps will appear at the seams when you sand it.

To sand the front of the cowl, I made a special sanding block out of three layers of lite-ply. The first two layers are slightly larger than the spinner, with the center cut out slightly larger than the drive washer on the engine. The last layer is drilled to the engine-shaft size with sandpaper glued to its face. Rotating this sanding block on the engine shaft will produce a perfect cowl-to-spinner air gap. I used washers between the tool and the engine and removed them until the gap between the spinner and section 1 was large enough to take an 1/8-inch balsa sheet with a little room left over. Then I bonded the balsa to the front of section 1 with epoxy. (This tool can also be used to add clamping pressure with the prop nut.) Then I installed the spinner and final-sanded the nose.

FIBERGLASSING THE MODEL

I've found that medium cloth works the best. I used Z-Poxy* finishing resin mixed according to the instructions and then thinned 60:40 with denatured alcohol. I prefer to mix it in small amounts and apply it with a brush. Begin by draping the cloth over the plane; then smooth it out and apply the resin from the center and work outward. The resin will thicken as the alcohol dries. If the glass doesn't lie down, apply a little more resin and give it a chance to thicken. Glass the inboard sides of the vertical stabilizers, then allow the resin to cure, and trim any excess. Now, glass the engine inlets and the outboard sides of the stabs. This is a good time to glass the elevators and ailerons using left-over scraps of glass and resin. As you glass the bottom of the fuselage, allow the glass to overlap itself all the way across the main gear area. When the glass has dried, sand it with 80-grit sandpaper, paying special attention to the overlapped areas.



Here's the servo layout. I used a control arm to hold the throttle cable in place. Note that the screw to the left of the control arm is used to hold the upper hatch down.

Now, install the balsa dorsal fins. Use light spackle to fill the cloth weave. You can add water to the spackle to give it a toothpaste consistency, then spread it on with your hand, or spread it straight from the can and spray on water to thin it as you go. After letting it dry overnight, sand off the excess with 180-grit sandpaper.

I installed the ailerons using conventional methods and sealed their ends with 5-minute epoxy to protect them from paint. To install the elevators, I laid the plane on its back and blocked up the nose until it was level. After removing the heat-shrink or tape from the torque rod, which peeks into the exhaust nozzle, position the control arm straight down. Cut a deep groove into the bottom of each stab using a drill press and router bit. Test-fit the stabs on

FLIGHT PERFORMANCE

The control throws for the test flights were aileron 1/2 inch up and down, elevator 3/4 inch up and down (both were measured at the TE).

• *Takeoff and landing*

During taxi and rollout, the Foamjet will bounce around, then smooth out as the airspeed picks up. I try to pick the smoothest spot on the field to rotate because a bump can cause a small model to rotate too soon. If this happens, I push the nose over to gain a little airspeed, then I climb out. Landings will surprise you because of how slowly this model will fly. This became apparent during a few dead-stick landings. I found 1/4 power is best with a straight-in approach. I then cut back to idle over the runway and let the plane settle in. I can get the Foamjet to takeoff speed in 60 feet on a paved runway and to vertical-climb speed in 80 feet.

• *Flying*

At high speeds, the model will go where you point it, and high-G maneuvers are no problem; the wings are very strong. The Foamjet is just as stable inverted as it is upright. If you fly from a paved strip and have the need for speed, try some smaller wheels. The model is very forgiving at slow speeds, losing only about 15 feet after a stall. On windy days (15mph), slow flight is a handful, so pick a calm day for the test flight. Get a little practice, be ready to turn a few heads, and have fun.

the torque tubes, then scratch up the brass and coat the torque rod and aluminum bearings with grease. Now block up the aft end of the fuselage at the torque rod. Slip the stabs under the torque rod on the top of the blocks, letting the rod settle into the groove. Put epoxy in the groove, but keep it away from the aluminum bearings. Grab the control arm, which should have a wire bent like a question mark, and rock it back and forth until the glue has spread all the way around the torque rod. Now check the control-arm position as well as that of the stab tips, LE and TE. The right and left sides should be the same. After the epoxy has cured, check for freedom of movement. You can fill the groove with spackle. Now, flip the plane over and bond the canopy in place, tape off the window area and add an epoxy fillet around it.

FINAL PREPARATION

I use an automotive touch-up gun to apply BIN Stain Sealer, thinned 60:40 with denatured alcohol. This can be applied with a brush but may require more sanding. I final-sanded the plane with 280- then 320-grit sandpaper. If you notice any exposed foam, seal it with resin before you apply paint. Don't forget the inside of the cowl and tailpipes.

Now, cut out the hatches. I've found that using a hobby knife, cutting at an angle and using small, short strokes works the best. When the hatches are free, fill any imperfections with a thin coat of spackle, then sand them and seal the edges with a coat of resin (not thinned this time). After the resin has cured, make and install hold-down hooks and put the hatches back on.

I used Top Flite* paint, first applying the lighter colors. The flight equipment is installed as shown on the plans. Make the servo mounts, attach them to the servos and you need only to epoxy the mounts into place.

I used a folded piece of foam rubber to install the radio. Next I pushed the fuel lines through the firewall, attached them to the tank and pulled the tank into position. I padded the tank with foam rubber, set the control throws as shown on the plans and double-checked their direction and the CG. Then I took off for the flying field!

The wing and tail sections are available from me for $30. Send check or money order to Keith Sparks, 7755 Nor-East Dr., Fort Worth, TX 76180; email: PSPARKS@world.att.net.

Addresses are listed alphabetically in the Index of Manufacturers on page 134.

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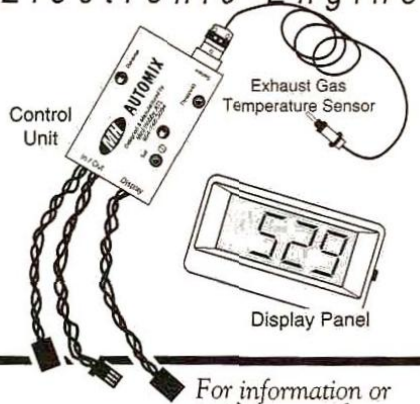

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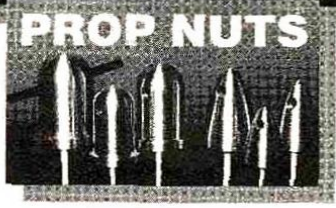

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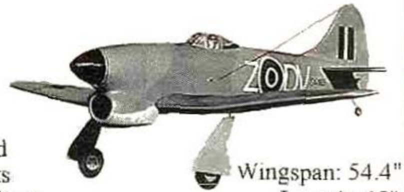

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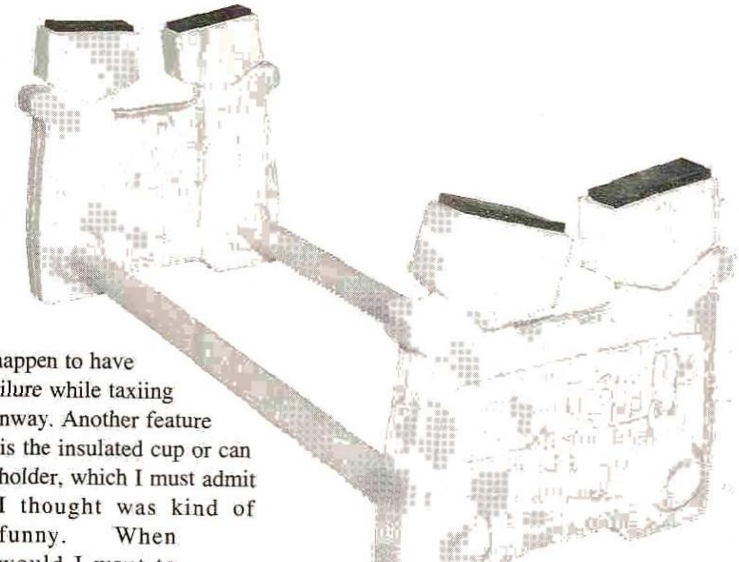
ROBART Super Tray and Super Stand II

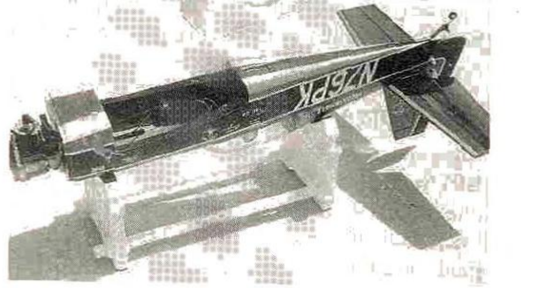
Better support—with foam

by GREG GIMLICK



Styrofoam has found its way into every aspect of our lives and most of us accepted its place in our hobby some time ago, but few of us have used it for anything other than wing-cores. Along came Robart* to show us how it can be used to do a whole lot more.

Their first entry into foam support equipment is the new Super Tray ($24.95) transmitter tray. Trays in various forms have been around for a long time and have gained popularity at a steady pace. Robart has designed this tray so that it fits your body comfortably and provides good hand rests on each side of the transmitter. The transmitter is held firmly in place with a hook-shaped rod that comes up through the bottom and hooks over the radio handle. I tried several radios to see whether there were any conflicts with switches, etc., and they all cleared nicely. There is a spot for you to store your Ni-starter, which is nice if you happen to have an engine failure while taxiing out to the runway. Another feature is the insulated cup or can holder, which I must admit I thought was kind of funny. When would I want to take a drink during a flight? The answer came when I attended an aerotow meet and saw folks flying their sailplanes for extended periods. They were comfortably sitting in chairs and drinking from soda cans they had close at hand in their Robart trays—neat idea. I've used the tray several times now and find it comfortable and stable when everything is adjusted, but I found I have a tendency to lean on it, and then the neck strap begins to hurt, so the addition of a pad to the strap was in order. I used one of the imitation lambskin pads available from automotive shops to cushion shoulder belts, and everything was comfortable.



The second addition to Robart's foam equipment line, the Super Stand II ($16.95), is the crowning jewel, in my opinion. I wasn't sure when I first assembled it, but once in use I found it incredibly useful. The two padded supports at each end can be adjusted to fit almost any angle required, and the adjustable length allows it to fit any fuselage or wing. That's right; I said "wing," because when you line the pads up so they're level, they hold a wing at a perfect height to be worked on on the bench. No longer do you have to block up the tips to prevent the servo from resting on the table when you need to trim or repair a wing. The distance between the ends is adjusted by sliding one or both ends toward the center, but they are very snug so be sure to do this carefully. I haven't broken one yet, but I'm sure to support one end on the floor and slide the foam end evenly along the plastic rods.

The two plastic tubes that support the foam ends are very light yet strong enough that I was able to move a ¼-scale Extra fuselage using the tubes as handles. I also supported a fuselage that had the antenna coming out of the cockpit and supported by the vertical fin; a normal stand would interfere with the antenna and pull it loose, but the Super Stand II has a gap between the support pads, so the antenna went between the pads and was protected from damage. It also has a wide base, so it didn't tip over in my van going to and from the field with my PT-19 fuselage on it. I recommend that you put something heavy across the base if you are transporting a heavy plane, though.

I like the tray and will continue to use it because it's comfortable and functional, but I must admit that I was really taken by the new Super Stand II—more so than by any other stand I've used. It has become such a valuable shop accessory that I bought another because one just wasn't enough. One of the big reasons to try these devices is their price; they are inexpensive, and that is very seldom the case with such useful tools.

** Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

SR It's one thing to get people to read your ad... ...It's quite another to get them to write it!

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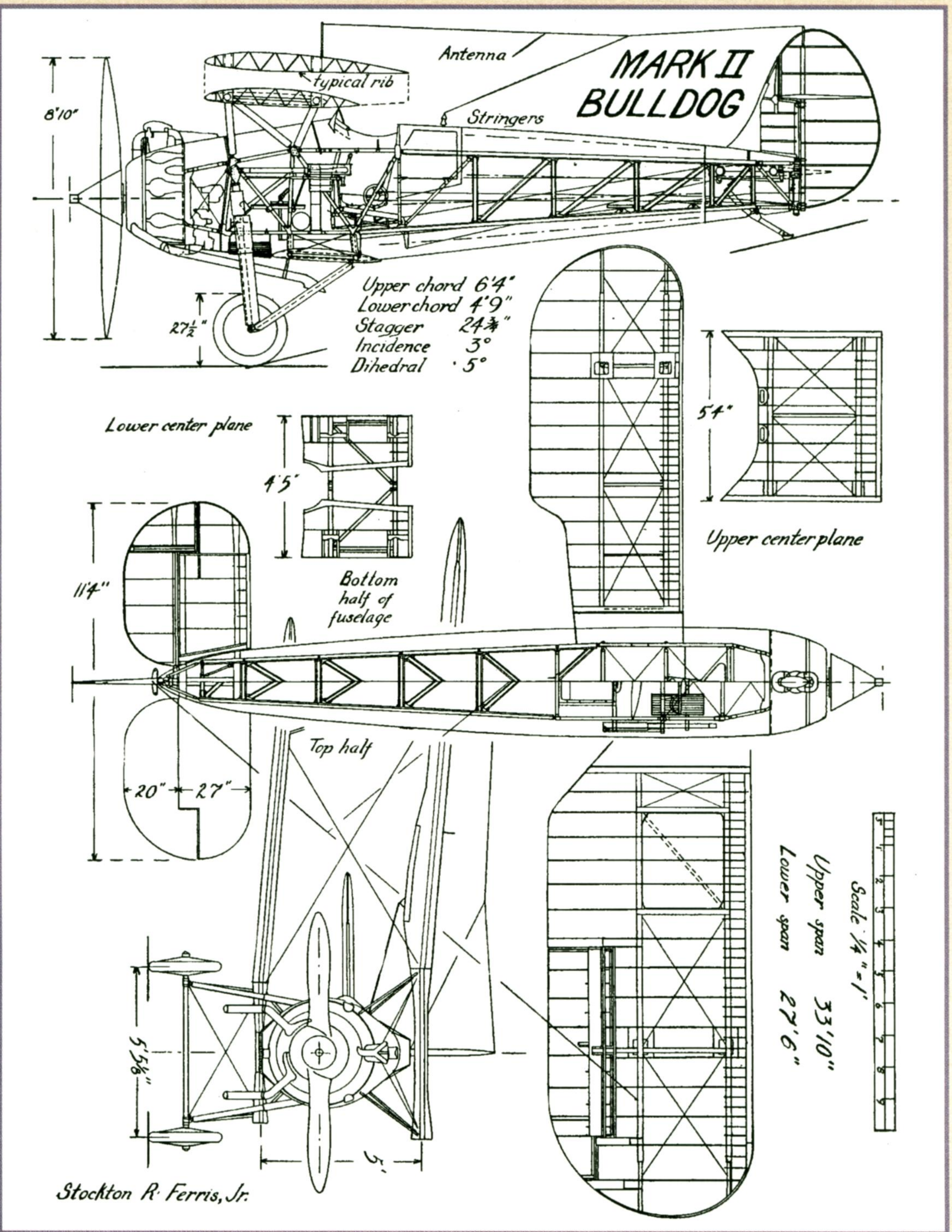
Bristol Bulldog Mk. IIA



SPECS

Name: Bristol Bulldog Mk. IIA

Manufacturer: Bristol Aeroplane Co.

Type: fighter

Wingspan: 27 ft., 6 in. (lower wing), 33 ft., 10 in. (upper wing)

Length: 25 ft., 2 in.

Height: 9 ft., 10 in.

Weight: 3,503 lb.

ONE OF THE most popular peacetime fighters in the Royal Air Force, the Bristol Bulldog Mk. IIA was one of the last open-cockpit fighter biplanes to see mass frontline duty, and at its peak, the fast, maneuverable single-seat plane constituted 70 percent of Britain's fighter force. It entered service in May 1929 and saw duty in 10 fighter squadrons until it was replaced by the Gloster Gladiator in 1937.

With a Bristol Jupiter Series 420 or 480hp engine, the Bulldog had a speed of 177mph at 10,000 feet and could reach that height in 6.7 minutes. A Barnwell design, it was a sturdy, unequal-span bipe with a light alloy structure and fabric covering, and Frise ailerons on its upper wing and adjustable trimming tailplane gave it excellent handling characteristics.

MODEL AIRPLANE NEWS
HOW TO

Making an older model airworthy

Renovate a Retired Flyer

by HENRY HAFFKE


The author's PT-20A had gathered dust in his workshop for two decades.

PHOTOS BY HENRY HAFFKE

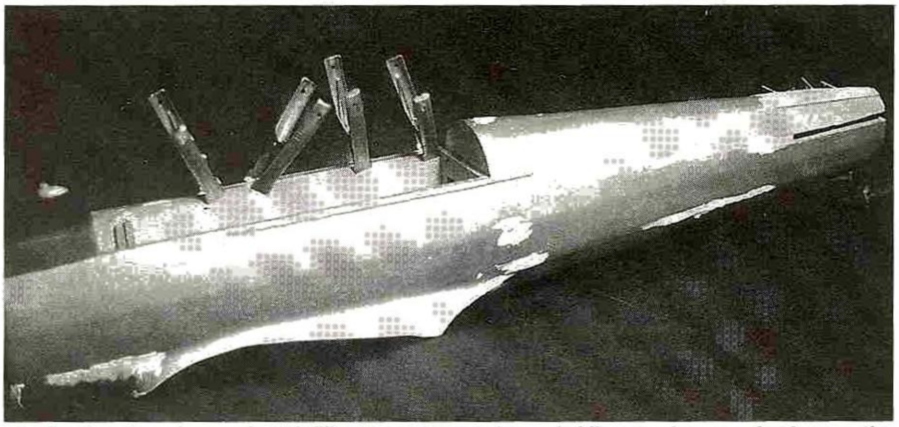
I am sure that many of you have an old model lying around that you haven't flown in a long time. It may have been put aside because of interest in a new project, or it may have suffered some damage that you haven't gotten around to repairing yet. These old dust collectors can, in many cases, be turned into a model that's even better than when it was new. Even a model that has suffered extensive damage can be transformed into one that has a lot of life in it. Looking at the damage, you may think it isn't worth repairing. Think again, and look at all the little parts that aren't damaged and could be used to put the model back together again.

I found plans for one of my all-time favorite aircraft, the Ryan ST, in the September '60 *Model Airplane News*. I reworked the free-flight design for 4-channel R/C, and as the model was nearing completion, I came across some photos of a military Ryan ST that was designated "PT-20." I liked its silver fuselage, yellow wings and tail surfaces with red, white and blue rudder stripes and stars on the wings. Modeling products of the sixties were not what we have today, and the nearest thing to a silver finish was Aerogloss aluminum dope, which really was more gray than silver. The newest covering on the market, MonoKote*, was perfect for the yellow wings. I reworked the model's cowl to hold an Enya .29, thereby turning it into a PT-20A. The 64-inch-span model weighed over 6½ pounds, which is quite light for such a large model. I flew the model extensively and entered it in a few scale meets. Its last flight was made on May 19, 1974.

When I worked for Coverite in 1982, I was involved in developing new products, including Micafilm. Up to this time, most modelers had not been able to finish a metal-looking model unless they used thin aluminum

With a new, larger engine, a few fix-ups and new covering, this renovated PT-20A is ready to take to the skies.

plates for covering. Aluminum paint didn't work well, as it contained aluminum dust that would be rubbed off a beautifully finished model when you handled it. My Ryan PT-20A had been hanging in my shop gathering dust for over 10 years since its last flight. As I had always thought it was a very attractive model, I thought of re-covering it with aluminum-colored Micafilm. This thought stuck in my mind for another 10 years but never got done because of other projects. In the meantime, I was involved with another Coverite product, 21st Century fabric. After covering three models with it, I told myself that I had to refurbish the PT-20A and eventually started late in the winter of 1996.



The fuselage is under repair with filler in cracks and clamps holding new longeron in place on the right side. A filler block is used to repair the fin mount.

FRONT-END FIXES

I decided to install a larger engine, a Saito .45. This involved changing the cowl openings and engine and tank mount (built as one unit). I also thought the cowl would be the most difficult part of the model to cover with the aluminum Micafilm. I reworked the engine and tank mount and mounted the engine so the prop was in the same position as it had been with the O.S. .29. The mount spacing didn't require any adjustment, as both crankcases were the same width. I filled the openings where the muffler and needle valve had exited the cowl with balsa blocks and enlarged the cylinder opening to accommodate the larger cylinder on the .45. I refinished these areas and sanded the entire cowl top. I also sanded the lower cowl after filling some small dings that were the result of nose-ups during the model's four years of flying.

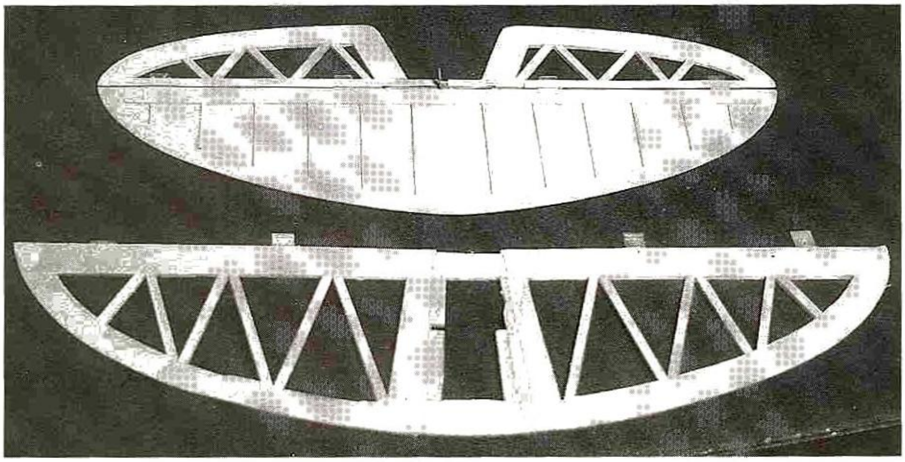
When covering (or re-covering) with film, it's important to get the model parts very smooth, as any flaws will show through (especially true with silver covering). I coated the cowl with Balsarite*, then I cut a piece of the aluminum Micafilm a little larger than the scale panel, ironed it on with my iron set at 225 degrees and trimmed the edges. Before ironing on the next panel, I brushed a coat of Balsarite on the underside edge of the new piece, where it would overlap the first. After the entire cowl had been covered, I simulated rivet lines with a dressmakers' tracing wheel and used a ½-inch-wide file card as a straightedge. The pressure required depends on the hardness of the balsa underneath. I suggest that you start with less pressure, as it is very easy to go over a line with more pressure. If the line is crooked, you can use your iron to shrink the holes and redo the line.

I sanded down the balsa and ply spinner and covered it with aluminum Micafilm. I painted the back of the propeller blades flat black and covered their fronts with chrome Presto*, which is an excellent material to use to trim models and can be applied without heat using your thumb and fingers.

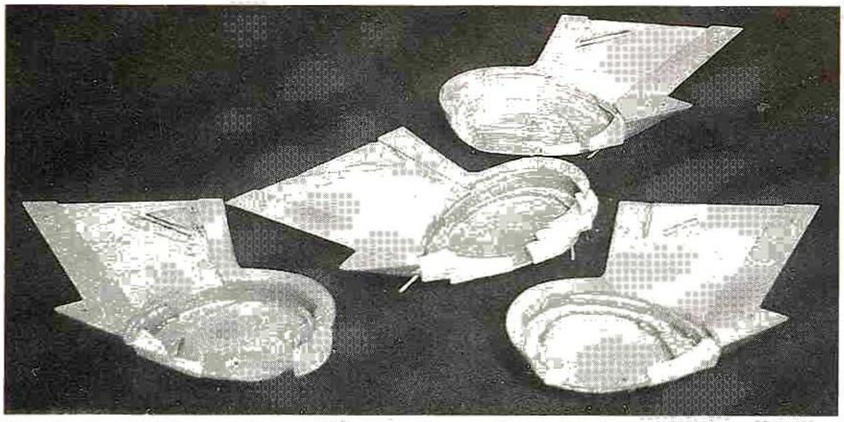
SPRUCING UP

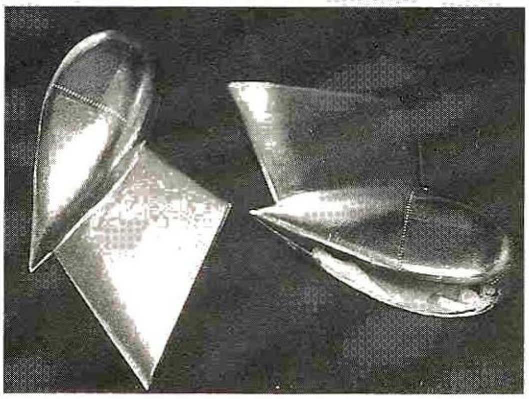
With the front end finished, the next difficult job was the wheel fairings. The fairings had sustained scrapes and other damage and needed a good going-over. I glued small blocks inside the fairings where necessary so their outsides could be reshaped. I filled the dings on the outside with Dapp spackling compound and carved and sanded the parts to their final shape. I brushed on Balsarite, covered each wheel fairing half with four panels of Micafilm and covered the upper leg fairing with one panel. I applied rivet lines as I had done on the cowl.

The next project was to redo the radio compartment hatch cover, which contains the two cockpits. I sanded the hatch and removed the windshields and cockpit coaming. After coating the hatch with Balsarite, I covered it with four pieces of Micafilm and made the seams where panel joints appeared on the real aircraft. I made new windshields and installed a new cockpit coaming. I also made new instrument panels with scale instrument placings, since I had good pictures of both the front and rear cockpit panels. Then I made new aluminum fittings out of aluminum flashing to attach the compression struts and flying wires. I made and installed a cockpit rollover bar, installed a new fuel gauge in front of the



The old stabilizer and the new, resized (scale) stabilizer and elevators ready for covering.





Above: wheel fairings receive balsa repair blocks before refinishing. Right: wheel fairings have been covered with aluminium Micafilm.

front windshield and installed the new windshields and added rivets.

FUSELAGE RESTORATION

The next job was to redo the fuselage. First, I cut the tail surfaces free of the main structure. The tail surfaces needed some work, and the top of the fuselage back (where the stab and fin go) was damaged. I cut away the damaged areas and installed balsa blocks where needed. Those of you who remember what happens to a doped and sheeted structure after a good number of years know that it will crack. I repaired the cracks by wicking CA into each one as I held the structure together. I then filled in the uneven areas around the cracks with Dapp spackling compound and sanded everything smooth. The external longeron on the right side of the cockpit area had deteriorated badly due to exhaust residue, so I cut it away, thoroughly cleaned the area and formed a new longeron from a birch dowel.

I sanded down the entire fuselage and applied a coat of Balsarite. Covering the fuselage with Micafilm was easy, as the Ryan's fuselage has no compound curves. (Many 3-views of this aircraft show a curved shape to the rear section in top view. This is incorrect; the rear of the fuselage was a constant cone shape with a straight surface from the cockpit area to the rear.) I cut panels of Micafilm to scale shape and ironed them on, starting at the rear of the fuselage, and then I made the simulated rivets as before. I covered the external longerons with Presto.

Now I had to make a new headrest. This is a simple affair. Cut off a 1-inch-wide balsa block, the bottom of which had been sanded to fit the top curve of the fuselage. On this model, the headrest holds the cockpit section hatch in place. A dowel pin near the rear of the headrest fits into a hole in the top of the fuselage, and a long screw goes through the forward part of the headrest to secure it to the fuselage. The headrest is covered with silver Micafilm, and the headrest "pad" is painted black.

About the real aircraft

Beautiful flight shot of a PT-20A in the clouds.

The Ryan PT-20A is a very interesting and unusual aircraft. It was a later development of the beautiful Ryan ST sport trainer that had been designed as an advanced primary trainer for the Ryan School of Aeronautics. T. Claude Ryan laid out the preliminary design for the ST in 1933. By early 1934, the design had been finalized and construction of the prototype began. The design was very sophisticated and everything worked out beautifully, including the use of the landing-gear design used on the 1932 Gee Bee racers. John Fornasero test-flew the prototype on June 8, 1934. His remarks were very promising: "She's perfectly balanced, handles easily and is the sweetest plane I've ever flown."

In 1936, the first export models were delivered. With the uncertain world affairs of the late '30s, the aviation world changed as

FIXING UP THE FLIGHT SURFACES


Closeup showing front-end details.

The tail surfaces were next. The fin and rudder needed some minor repairs and were then covered with 21st Century fabric. As the original stab and elevators had been repaired a few times, I decided to build a new stab that had scale rib spacing and elevators using a new leading edge and the original (shortened) trailing edges. I covered these parts with 21st Century fabric, hinged the elevators to the stab and fit the stab to the fuselage. Then I added the fin and rudder. The aircraft number "50" was cut out of Coverite graphic trim sheet and applied to the fuselage. I painted the section forward of the front cockpit flat black as an anti-glare panel.

The final job was the wing, which needed only minor repairs to some wingtip scuff marks; these were filled with Dapp spackling compound. The entire wing was sanded very smooth, and after applying a coat of Balsarite, I ironed on the yellow 21st Century fabric (except at the wing center section, which was covered with silver Micafilm). The red, white and blue wing stars and black "U.S. ARMY" on the bottom of the wing were cut out of 21st Century fabric and ironed into place.

Final detailing involved adding a wing walk of fine sandpaper, which was coated with Balsarite on the underside and then ironed into place, and flying and landing wires and their fairings. The compression struts were made out of streamlined aluminum tube. I fitted and attached the front end to the fuselage, secured the landing-gear fairings to the wires in the wing and bolted the wing to the fuselage.

The Ryan PT20-A shapes into a very striking model that is a real eye-catcher. It's a great feeling to see such a beautiful model back together again. Think twice before you trash the old model that has been hanging around your shop or was damaged the last time you flew it. Rebuilding that old bird can be very gratifying and can save you time and money.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

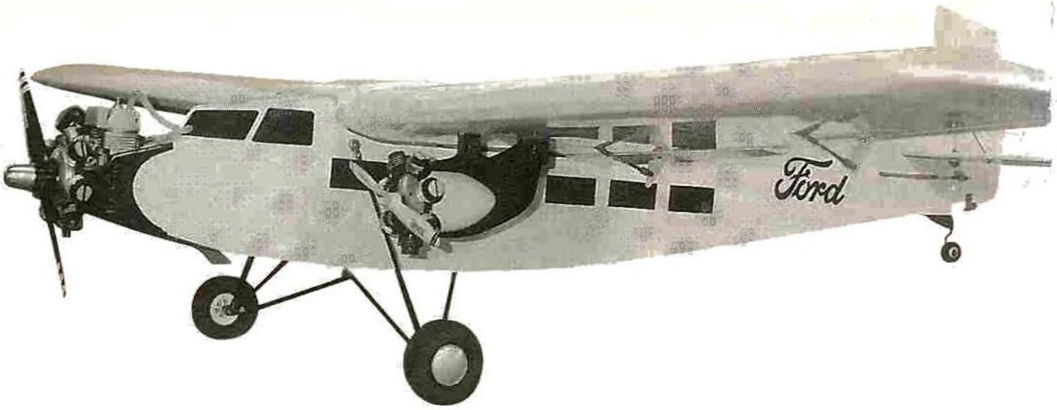
Left: pilots head out to their aircraft for the day's flight training in the original PT-16 trainers—the first Ryan trainers in the military.

The military soon discovered that servicing the Menasco engines was a nightmare, and they searched for a suitable substitute. Twenty-seven PT-20s were refitted with Kinner R-440-1 engines between October and December of 1940; these aircraft became PT-20As.

most manufacturers shifted their production lines to war-related aircraft. To enter the fast-growing domestic military market, Ryan developed the STA-I for evaluation in the 1939 U.S. Army Air Corps primary trainer competition. Its performance won a 15-plane service evaluation order. An order was placed for 30 models carrying the designation "PT-20," modified slightly with the cockpit load-carrying longerons moved to the outside of the fuselage, larger cockpit openings and rollover posts.

A Ryan PT-20 before being converted to a PT-20A.

MODEL AIRPLANE NEWS
HOW TO



by C.H. BENNETT

MAKE CONCEALED AXLES
Improve wheel appearance and security

AFTER I HAD COMPLETED a good-flying Ford Tri-Motor model, I took a long look at the main gear wheels, which had functional—but somewhat ugly—exposed wheel collars. I wanted the finished wheels to have slightly domed, "baby moon" wheel discs like those on full-scale Tri-Motors. This article explains what I did to improve the appearance of the wheels.

Essentially, this method involves fastening the wheel assembly using one wheel collar mounted to the axle, inboard from the wheel. The setscrew in the wheel collar goes through a brass tube bushing and is locked into a flat that has been ground into the axle. A suitable low-profile, rounded screw head is on the outside of the wheel, and it can't come loose, as it is soldered into the brass tube. You can then add a hubcap to cover the outside of the wheel.

1 In this instance, I used a 5/32-inch axle with a typical 2¾-inch-diameter foam tire. (You can also use this method with 1/8- and 3/16-inch music-wire gear axles.) Here, I use 3/16-inch o.d., 5/32-inch i.d. brass tube and no. 8 thread, low-profile brass screw heads (terminal screws from household receptacles and switches). I cut off the surplus thread to leave about 3/32 to 1/8 inch under the screw head. I sweat-soldered the screw heads in place using a suitable length of the brass tube. (It helps to use a longer length of tube while you're soldering it.) I solder both ends on before making the final cut. Try to make a good joint without leaving a large fillet of solder, but if a little is left, you can chamfer the wheel bore to compensate.

2 Cut the tube to the proper length using a grinding wheel or tube cutter and deburr its i.d. so you can easily slip the tube over the axle. (Determine the length using the sketch, taking into account the wheel thickness and space for thrust washers or side clearance.)

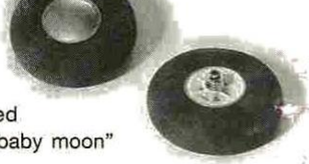
Use a felt-tipped pen to mark where you'll grind a flat through the brass tube and into the axle in one motion. Be sure the flat faces in a direction that you'll be able to access later.

The flat should be about 1/32-inch deep, and the width must be greater than that of the wheel-collar setscrew. In this case, I made the slot width about 5/32 inch (the 5-40 setscrew has a 0.120-inch diameter).

When you pull the tube off the axle, the slot will deburr itself to some extent, but you should touch it up with a small file or scrape it with a no. 11 blade.

3 Here are the inside and outside of two wheel assemblies. In this case, the plastic wheel bores must be opened to freely accept the 3/16-inch o.d. brass tube.

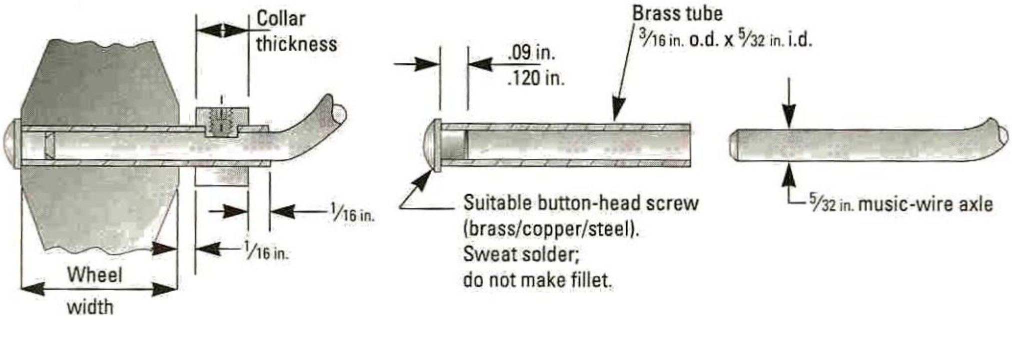
Redrilling these plastic wheels properly is a must to avoid wobbly runout. I do this in a drill press, opening up the bore successively 1/64 inch at a time until the tube fits properly. I drive from both sides of the wheel so that the drill centers well.



4 To dress up the wheels a little more, I epoxied on soda can "baby moon" wheel covers.

A word of caution: during final installation, the setscrew must be accurately aligned to the slot in the tube and the axle flat. Wiggle the setscrew judiciously so you can "feel" whether it has entered the tube properly before you tighten it; otherwise, you could easily crush the brass tube. A little light grease or oil will also help everything slide together easily.

The idea has worked well for me, and I have made this change to four planes so far. ✈

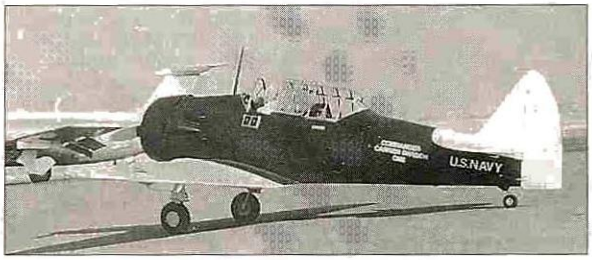


PHOTOS BY C.H. BENNETT

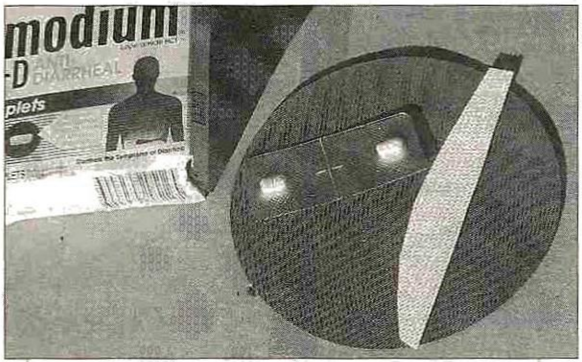
A little imagination goes a long way

Easy Pilot Headphones

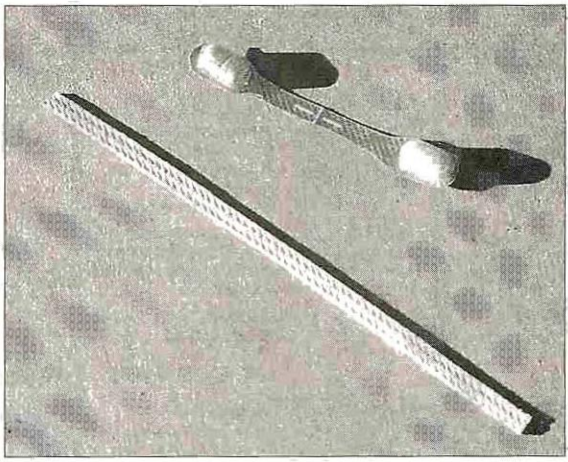
While completing my latest project, a Midwest AT-6/SNU, I needed a set of headphones for the rear admiral pilot. Having none on hand for a 1/5-scale pilot, I did what any scale builder does: improvise!



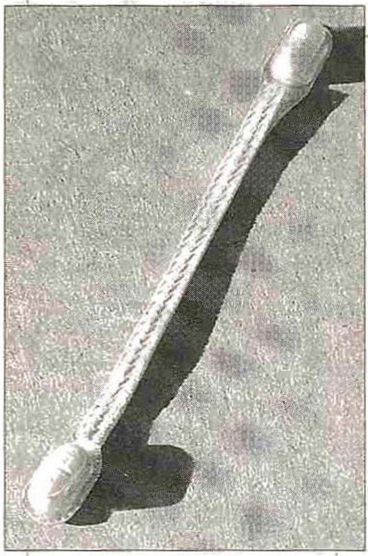
by CARL DIEHL



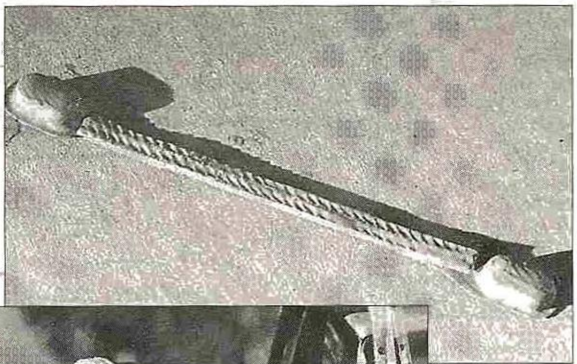
1 Two pills in their plastic containers, a rubber jar-top remover from the kitchen and rubberized drawer-liner material are all you'll need.



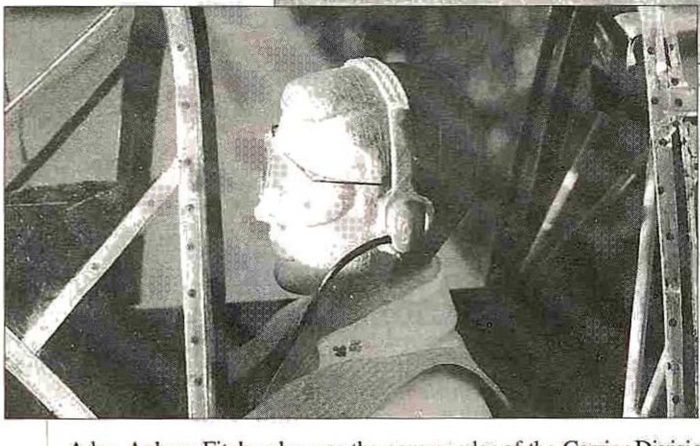
2 The pill packs have been cut down to retain the backing and set the shape of the headphones. Use a strip of the drawer liner for the head strap.



3 Cut the pill packs apart at the separation line, and CA them to the strip of liner. The assembly will stretch to fit over the pilot's head.



4 Paint the headphones only with water-based (acrylic) paint (or the pill packs might be distorted or dissolved).



5 The finished product is CA'd to the ears of my 1/5-scale Williams Bros.* pilot. If you like, you can also use CA to attach a piece of rubber-covered wire to one of the earphones and to the dashboard. Note: my 1940 SNJ-2 was piloted by Rear Adm. Aubrey Fitch, who was the commander of the Carrier Division I during 1941 and flew from the USS *Saratoga;* therefore, I used a sportsman-type pilot with a white shirt, etc.

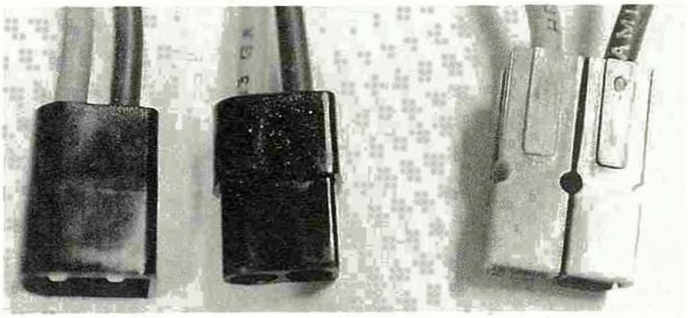
This easy add-on really spruces up the cockpit and adds to the realism of my model. Try it!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

Current THOUGHTS

by LARRY MARSHALL

CATCHING UP ON THE MAIL



From left to right: male Zero Loss connector, female Zero Loss connector, Anderson Powerpole connectors.

THOUGH I PROMISED last time that I would start talking about motors, I've decided to postpone that because of all the mail I've received in response to my "no math" series. Many questions were asked that are far more important than motor knowledge to initial success in electrics. It seems that since so many of you have gone to the trouble to read my words, the least I can do is try to respond to some of the questions those words have generated.

STALL SPEED

A few people were concerned about the arithmetic associated with my calculation of stall speed. The equation I used (3.77 x SQRT [wing loading]) has been used to guesstimate stall speed for a long time. Stall speed is a function of a bunch of stuff, not the least of which is the parasitic drag of the aircraft, the coefficient of lift of the airfoil, etc. Since we don't know any of those things for our aircraft, I didn't see any reason to use complicated arithmetic requiring those parameters when all we were trying to do was get some idea of what the stall speed would be so we could use rules of thumb (which themselves are subject to critique). Some of you may have seen this equation when Keith Shaw used it in his classic article on powering twins (*Model Airplane News,* December 1991). His methods have been used by electrics flyers in one form or another since he presented them. They get you close for "typical" aircraft. For those who wondered, this equation assumes a coefficient of lift equal to 1. If you want a more precise method for calculating stall speed (presuming you've got the data), check out Andy Lennon's book, "R/C Model Aircraft Design" (available through our book service). His method is much more accurate and better when your goal is to understand aerodynamics.

POWERING 2-METER SAILPLANES

By far the most common question asked of me in the last few months has been, "How do I get my 2-meter electric sailplane to fly better?" Most of us who have been flying electric airplanes for a while know the story. Modelers buy a Goldberg* Electra or Great Planes* Spectra. They build these great flying models and then, following the instructions, set up the power system using the motor and prop included in the kit. The results are lackluster performance and disappointed modelers who believe that electric power is impractical. What I can tell you is that assessing electric power from this experience is similar to assessing glow power by trying to fly a 3-pound airplane with a TD .049.

The Master Airscrew gearbox/motor/propeller combination is an inexpensive way to improve the performance of a 2-meter electric sailplane.

The problem with these electric sailplanes rests with the power system, not the power type. The motor supplied with these kits is a Mabuchi 550-series motor. It's an inexpensive ferrite motor; you could buy one for a few bucks, and the truth is, it's barely adequate as a power supply if set up optimally, and that's not how it is set up in typical installations. If you really want to make your sailplane climb like a homesick angel, you'll need to replace that motor with either a brushed cobalt motor or a brushless motor, a good gearbox and good cells.

But let's assume that you don't want to spend that much money, and let's talk about what you can do to improve the performance of the ferrite motor. First, let's look at the situation using the simple numbers approach presented in the last few columns. I'll assume the sailplane weighs 3 pounds. If so, it needs 150 watts into the motor; 50 watts per pound, right? Typical installations use an inexpensive 6-cell battery

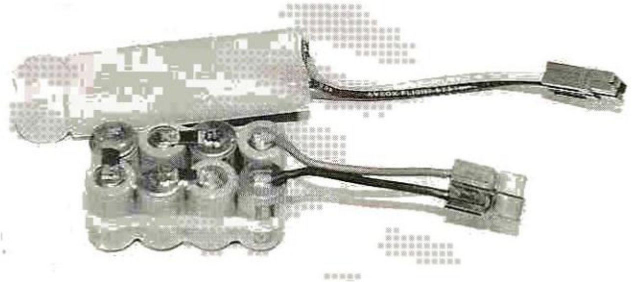
The AstroFlight Whatt-Meter is an invaluable tool for setting up electric power systems.

that's sold to power electric cars. To get 150 watts to the motor requires that we load it with a prop such that it's drawing 150÷6 = 25 amps. Well, the 8x4 prop provided with those kits will only load it to about 15 amps, giving the plane 6x15 = 90 watts heading into the motor, or only 30 watts per pound. Explains a lot, doesn't it? But there's a reason for the inclusion of the 8x4 prop; these ferrite

motors don't work very well once you get the currents above 20 amps. So you probably could move up to a 9x6 prop (with 6 cells) before causing problems, but there are better alternatives.

First, you could add a cell. The effect will be to increase the current draw to around 18 amps with the 8x4 prop (18x7 = 126 watts). The whys and wherefores of the increased current draw will have to wait, but it's obvious that the extra cell improves things considerably. It will help, and this step is needed to reach the goal of a good flying sailplane; but it may or may not be sufficient to make you really happy.

One reason is that so far, all of our discussion has assumed that you have a good connection between the battery and the motor. Unless you've eliminated the connectors that came with your setup and replaced them with Sermos*, Anderson Powerpoles*, or AstroFlight's* Zero Loss connectors, you're losing roughly 1/2 volt for every set of connectors you have in the plane. If you've set things up as the instructions suggest, you'll have two sets of connectors, and although you're throwing the voltage from one of the cells overboard, your plane still has to haul the cell's weight. Imagine reducing the rpm of your motor by 1,000, and you'll get the picture of what's happening. Change those connectors.



Here are a couple of typical Speed 400 batteries. The pack in the rear has 7 cells, while the pack in front has 8 cells. Both were made using Sanyo 600mAh cells.

The truth is that a really big problem here is the prop; it's just too darn small. I've mentioned before that large-diameter, deep-pitch props are more efficient than smaller propellers, and this is certainly true when the goal is to pull a big draggy sailplane skyward. Adding an inexpensive Master Airscrew* 2.5:1 gearbox (or some equivalent) to your Mabuchi 550 motor so that you can spin a 12x8 prop instead of the 8x4 will improve your climb rate by almost 40 percent. The only rub here is that the stock 2-meter planes must be modified slightly to accommodate the gearbox. The little bit of required work is worth the effort, however.

This discussion should tell you that you need some way to measure the current flow through your system so that you can monitor current draw when trying different propellers. Without it, you may burn up your motor. Using such a meter, keep the current to these ferrite motors at or below 20 amps, and you shouldn't have any problems. One of the most important tools I own is the inline current/voltage meter sold by AstroFlight; they call it the Whatt-Meter. I highly recommend it if you're interested in electric flight.

SMALL PLANE POWER SYSTEMS

Many of you wrote to ask about small model power systems. The popularity of Speed 400 planes has certainly raised interest in this area. Actually, this is an area where I don't really use rules of thumb, as there are a limited number of permutations with available equipment, and experience has taught us what to use.

Most Speed 400 sailplanes are 55 to 60 inches in wingspan. Either the Graupner* 6V motor on 7 cells, or 7.2V motor on 8 cells works best (6x3 folder prop). Using a gearbox isn't a bad idea with these sailplanes, for all the reasons I've mentioned above, but I haven't seen a lot of them in use in Speed 400 sailplanes.

Warbirds and sport planes typically span 30 to 32 inches, and the best system is the 6V motor on 7 to 8 cells and a 6x4 prop. If you want to fly faster and your plane is low drag, try a 5x5 prop. Flying a high-wing monoplane with a Speed 400 motor generally means a plane with a 40- to 45-inch wingspan, a 6V motor, 7 to 8 cells and a gearbox such that you can spin an 8x6 or 9x5 prop. Sometimes, a 7.2V direct-drive motor and 7 cells are used on these planes.

If you keep the planes within "typical" weights, these choices work well. Warbirds and sport planes should weigh 16 to 20 ounces, sailplanes 18 to 22 ounces, and you might get away with 22 to 24 ounces with the high-wing monoplane, but lighter is always better.

I suppose a note about Speed 400 cells is in order. Use either Sanyo* 500AR or SR* 500s if you want to charge at high rates. Use Sanyo 600AEs if you want a bit more capacity and are more patient (charging these cells at rates greater than 1.5 amps is not a good idea). You'll find the 600AEs are cheaper and the cells most commonly used by the Speed 400 guys, but the choice is yours. Personally, I'm moving from 600s to 500s because I like the faster charging and feel the cells hold up better to the uses to which we put them. Because the rapid-charge cells will provide better voltage under load than the "E"-type cells, you don't lose as much duration as you might think if you use good throttle management.

THE ORME METHOD

I had an interesting conversation with Matt Orme of Aveox* about quick methods for guesstimating the power system required to fly an airplane. Matt has to do this a lot for people who want to buy an Aveox power system for a particular plane. What Matt does is ask, "How much wing area?" He divides this simple number by 50 for high-wing planforms and by 35 for a low-wing aircraft; the result is the number of cells required to fly the plane. If we apply this to the Hangar 9 Cub we've been talking about, that would be 950÷50 = 18. And his system works, as our Astro 40G on18 cells would fly the plane pretty well. I've applied his rule to a lot of aircraft, and it works pretty darn well for such a simple rule. As with most rules of thumb, extremely small aircraft—or those that are very lightly loaded—start to deviate from predictability with this rule, but his method is worth considering when you're trying to narrow down your power system needs.

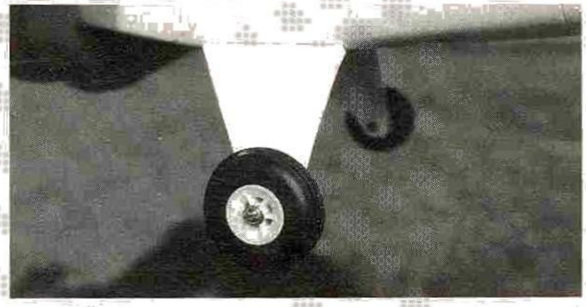
CACTUS AVIATION CHRISTEN HUSKY

At the Toledo show, I found something that seemed out of place in the Cactus Aviation* booth. As you probably know, these guys make big, beautiful, fiberglass models. But in among the ⅓-scale Pitts Special and huge Bearcat models they offer was a tiny, Speed 400 Christen Husky. The owner, Bobby Wilson, told me that he recognized the popularity of these planes and thought he'd import one.

Those of you wanting to get into a Speed 400 plane quickly will be glad he did. The Husky comes nearly ready to fly. The fuselage is fiberglass and is gelcoated, with etched panel detail. The tail feathers come covered, as do the two wing panels. The pushrods and aileron torque rods are pre-installed. Control surfaces come pre-hinged with tape.

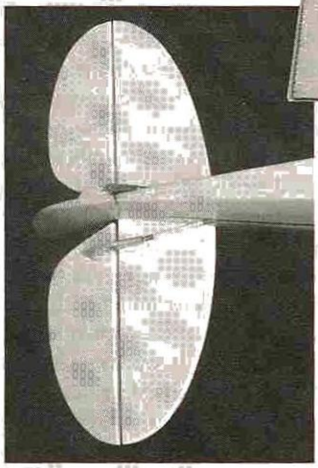
What you have to do is glue the two wing panels together, glue the tail feathers onto the rear of the fuselage and bolt the landing gear onto the plane. Then you'll be ready to install the radio gear and motor system. The kit comes with typical servo-mounting blocks with cutouts for microservos (three are required).

What doesn't come with the kit are materials to mount the motor. I used one of Tim McDonough's* motor mounts, modifying it to fit the nose of the Husky. I used a tool similar to the one Jim Ryan used when he installed the firewall in his SkaT (*Model Airplane News*, July 1998), using CA to tack it in place. Because of the odd shape of the Husky nose, I then injected some Zap-a-Dap-a-Goo II* between the firewall and the front of the fuselage to hold the firewall in place. I used FMA* S-90 servos and a JR* R-600 receiver for the radio gear and a Castle Creations* Sprite-20, 6V Graupner Speed 400 and 7-600mAh cells for power. The wheels are 1¼-inch tailwheels from Great Planes*. The end result was an all-up weight of 21 ounces. I measured the wing area of the 36-inch wing at 198 square inches, producing a wing loading of 15.3 ounces/square foot.



I used 1¼-inch tailwheels from Great Planes, and they look just about right for this plane.

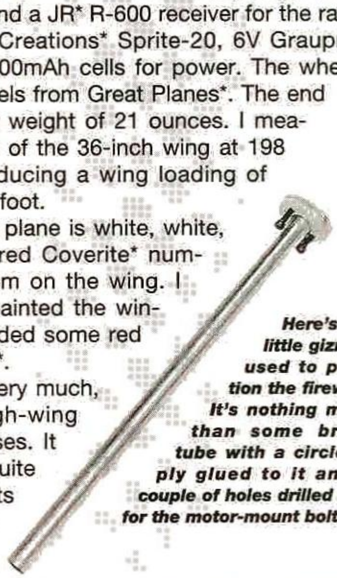
I modified a square Tim McDonough motor mount to fit the Husky nose by rounding the top and bottom edges. This made a convenient firewall for mounting the Speed 400 motor.



All the control surfaces come pre-hinged, and all the control hardware is already in place; this makes the Husky a really quick build.

As it comes, the plane is white, white, white. I had some red Coverite* numbers, so I used them on the wing. I masked and then painted the window areas using Floquil* silver paint and added some red fuselage stripes cut from stick-on MonoKote*.

I haven't had a chance to fly the plane very much, but it flies pretty much like any small, high-wing monoplane and doesn't present any surprises. It should serve the role of a small field flyer quite well for those who want to open their wallets a bit to save a bunch of time. Cactus Aviation sells this kit for $149.95.



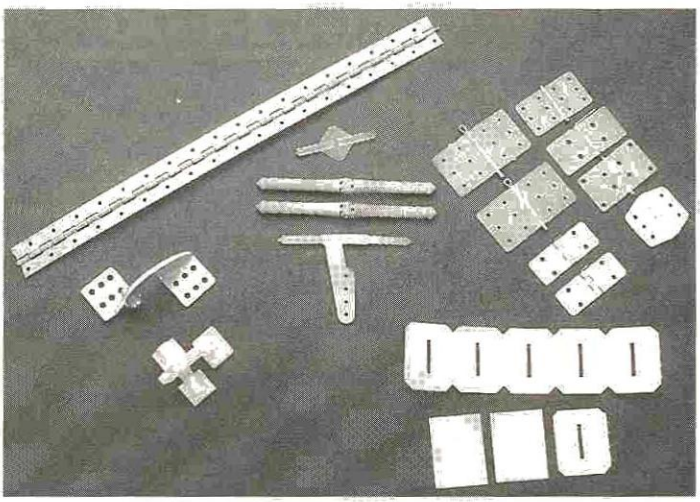
Here's the little gizmo I used to position the firewall. It's nothing more than some brass tube with a circle of ply glued to it and a couple of holes drilled in it for the motor-mount bolts.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

Thinking BIG

by GERRY YARRISH

HINGES FOR BIG BIRDS



Hinges come in all sizes and shapes. Which is the best for your big bird? Read on.

ONE THING ALL model airplanes have in common, no matter their size, is that they have some sort of hinging that allows their control surfaces to move. From some of the comments I have heard around the flying field, it seems that for some modelers, the proper installation of hinges is viewed as a difficult task. This time, I thought we'd talk about various hinges and their proper installation.

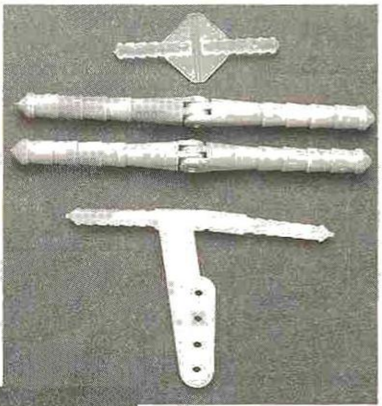
HINGE TYPES

To keep things simple, I have divided the multitude of hinges available today into five basic groups. These are: flat/creased, flat/pinned, Hinge Point, EZ/CA-glued and metal piano/specialty hinge. Let's look at each.

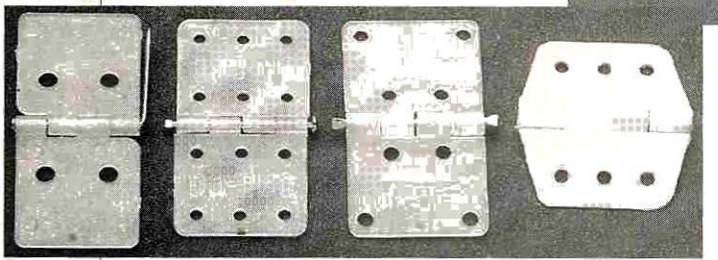
• **Flat/creased.** This is the very old type of hinge often found as part of a kit's free hardware package. They are usually made of some sort of molded plastic and are creased (or have a thin cross-section in the middle to allow flexing). I don't use these hinges, as I feel they are too stiff; I prefer EZ/CA-glued hinges for small sport models.

• **Flat/pinned.** These are the conventional, everyday hinges used on most of today's model airplanes. Most of these are also made of molded plastic, but some are made of thin metal. They consist of two halves joined in the center with a hinge pin. Sometimes, this pin is removable to allow separation of the hinge halves and, thus, removal of the control surface from the model. The pin is often in the form of a small cotter pin. Flat/pinned hinges are available in various sizes and styles; some have holes in each half for better glue strength, while others have ridges to help anchor them to the model. Flat hinges are installed into slots cut into the edges of the control surfaces and the wing's or stab's TE.

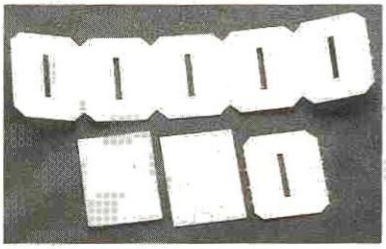
• **Hinge Point.** These differ from flat hinges in that they are circular in cross-section and are installed in holes that have been drilled in the surfaces being hinged. Robart Mfg.* came up with the design some time ago, and these types of hinges are very popular with scale modelers because when installed, they look much the same as full-size aircraft hinges. Their pins are not removable, but Robart does make Hinge Point Pockets that can be installed in the model to facilitate control-surface removal.



Above: Hinge Point hinges are designed for insertion in holes drilled in the control surfaces. Scale modelers use them because they look much like full-scale hinges when installed. Note that the top hinge is a combination of a Hinge Point and a flat/creased hinge.



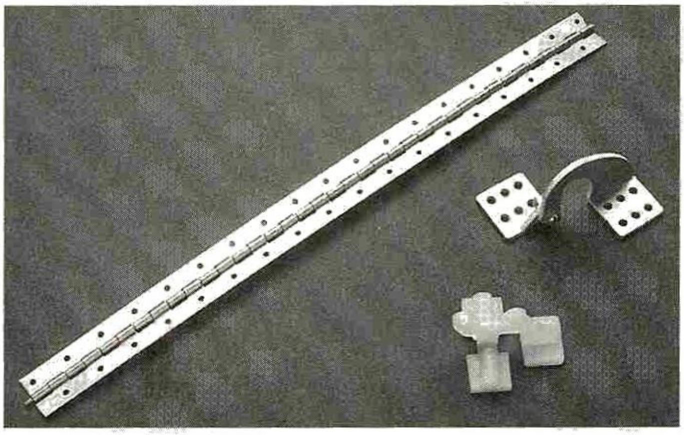
Holes are used in the hinge ears to help the glue grip the hinge securely. Some hinges have ridges for the same purpose.



EZ/CA-glued hinges are also very popular these days, and they can be used in some lightweight big birds. Just use a lot of them and install them in tight-fitting slots.

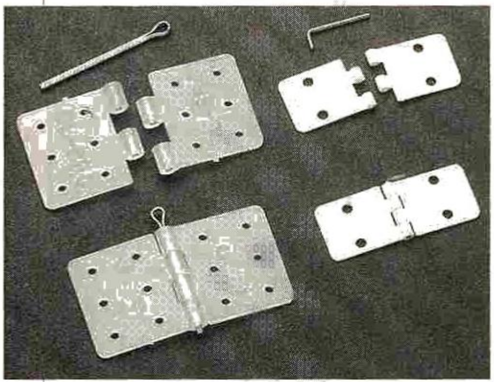
• **EZ/CA-glued.** These hinges are made of a strong, cloth-like fiber and are meant to be held in place with CA glue. Available from several companies, all EZ/CA-glued hinges are glued into tight-fitting slots cut into the hinged surfaces with a hobby knife. Don't try to install EZ/CA hinges into slots cut with a slotting tool, though, as this tool produces a slot that is much too wide for proper gluing; more on this later.

• **Metal piano/specialty hinge.** The hardware-store variety of metal piano hinge has been used very successfully in big models. Smaller piano hinges are also available and can be acquired from Nelson Aircraft Co.* This hinge is often used for scale hatches and other non-control-surface uses. If you



Piano hinges and specialty hinges like these are best suited to doors, hatches and flush-fitting surfaces.

decide to make your own giant-size piano hinges from the hardware store, be certain to use aluminum hinges and secure the hinge pin in some way to prevent it from sliding out during flight. Specialty hinges such as offset hinges from Robart, BVM* and Jet Model Products* are very useful indeed when it comes to making landing-gear doors, bomb-bay doors, etc. Spoilers, flaps and other flush-fitting surfaces are excellent places to use this type of hinge.



Hinges with removable hinge pins allow the control surfaces to be removed.

DOES SIZE MATTER?

There is nothing wrong with using standard-size hinges in a really big bird, if you simply use more of them for each control surface. Some modelers just don't like the look of the so-called "giant" hinges, so they use smaller hinges in larger quantity to achieve the same strength. Typically, I'll use five standard-size hinges in a model instead of using, say, three giant-size hinges for an elevator half or a rudder. In truly gigantic models such as the 42-percent-scale TOC models and the odd 50-percent-scale Extra 300 show plane, as many as 13 large Robart Hinge Points can be used to secure a single aileron. Like the bed-of-nails trick, using several smaller hinges helps spread out the load.

INSTALLATION

Regardless of which type of hinge you use, it will only be as strong as its installation. If you don't use enough glue or do not provide enough purchase for the hinge, it will easily pull out of the structure.

When planning your hinge installation, the first thing you need to do is install balsa blocks in the areas where the hinges will be. Sufficient balsa is necessary to ensure that the hinge ear is completely encased in wood; this provides proper glue bonding to support the hinge. Neglecting to install these blocks is the most common reason that hinges pull out. The material you are installing your hinges in also has a bearing on which type of glue to use. If you're installing hinges in a foam wing, it is best to use epoxy; for wood structures, though, aliphatic glue is preferable. Here's why:

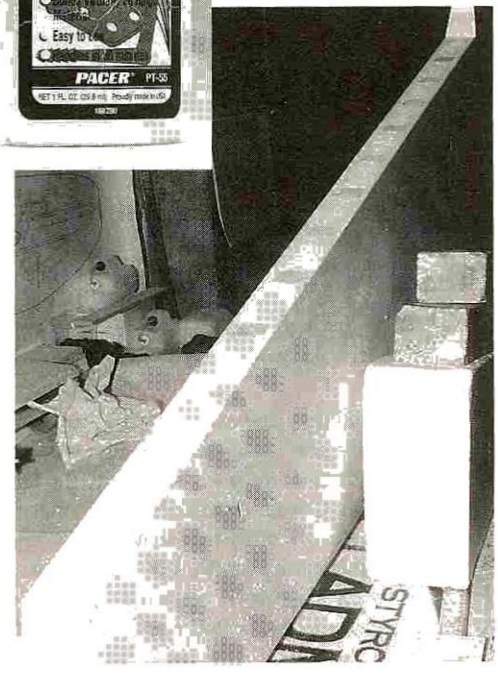
Aliphatic glue is water-based, and the moisture in the glue swells the wood fibers that surround the hinge ear. Besides bonding the hinge to the wood, the hinge slot actually becomes tighter and "clamps" the hinge more securely than if you used a non-water-based glue. Pacer Technology* makes a special adhesive that I like very much; it's called Hinge Glue. This stuff acts much like an aliphatic glue in that it swells the wood but is also formulated to adhere better to plastic hinges. Cleaning the glue off the hinge barrels can be done with a damp sponge.

IS GLUING ENOUGH?

In my experience, properly glued and supported hinges provide more than enough strength under normal flight conditions. Some modelers, however, find it comforting to cross-pin the hinge ears in place with either common straight pins or small sections of toothpicks. Pinning the hinges this way requires that you install the hinges before you cover the model so as to hide the unsightly pinheads or toothpick pieces. Be careful when drilling holes for the installation of toothpicks, as you can actually weaken the TE if you don't do it neatly. To pin or not to pin is entirely up to you.

Left: the name says it all; Hinge Glue from Pacer works very well and cleans up with a damp sponge.

Below: there's strength in numbers. This 50-percent-scale Extra 300 wing has 13 balsa blocks installed to hinge its aileron!



Du-Bro* has an excellent hinge-slot-cutting tool set designed to make installing hinges quick and easy. If you haven't tried it, you're working too hard installing your hinges.

In large, powerful models such as Madera-style unlimited racers, I have seen metal piano hinges "pinned" into place using flush-head machine screws. This setup is very strong and easily removable.

OTHER METHODS

Two other hinging methods I've used are the sewn, or "baseball stitch" type, and the machine-sewn fabric hinge. Both are quite strong and very easy to do.

The baseball stitch is perhaps the oldest type of hinging known to modelers. It requires that several holes be drilled along the control-surfaces' edges; then, the two surfaces are sewn together with strong thread using a figure-8 stitch. It is completely suitable for modern and old-time, vintage models. It would not, however, be my choice for a scale model, simply because of its appearance.

For the machine-sewn fabric hinge, you cut two strips of iron-on fabric (about 1 inch wide), place them adhesive side to adhesive side and then machine-sew them together along the long center. When opened, the cloth hinge forms an "X" cross-section and can be ironed in place before you paint the model. Though not as free-moving as the baseball-stitch hinge, the iron-on-fabric hinge produces a completely sealed hinge line and is almost invisible after the model has been painted.

So there you have it for model hinging. Hinges aren't very difficult to install, but they do need to be installed properly; the life of your model depends on it.

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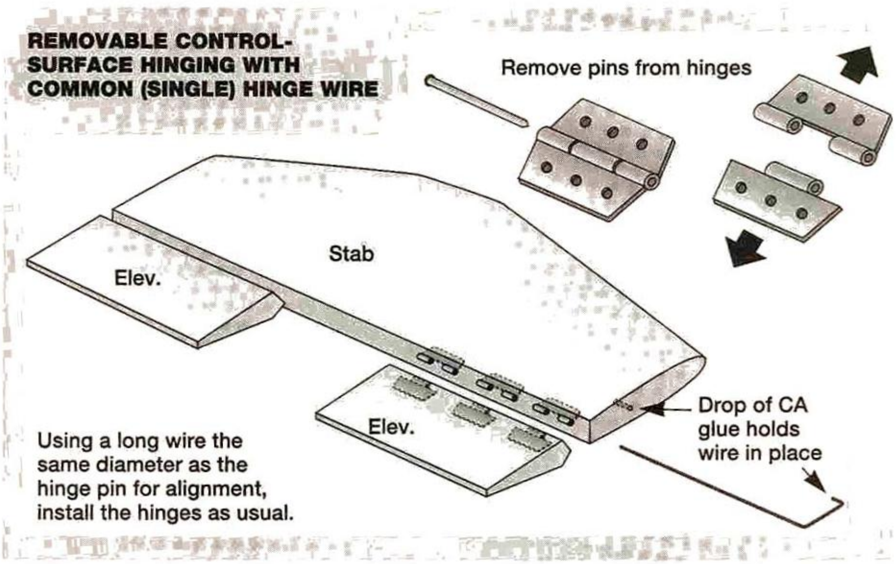
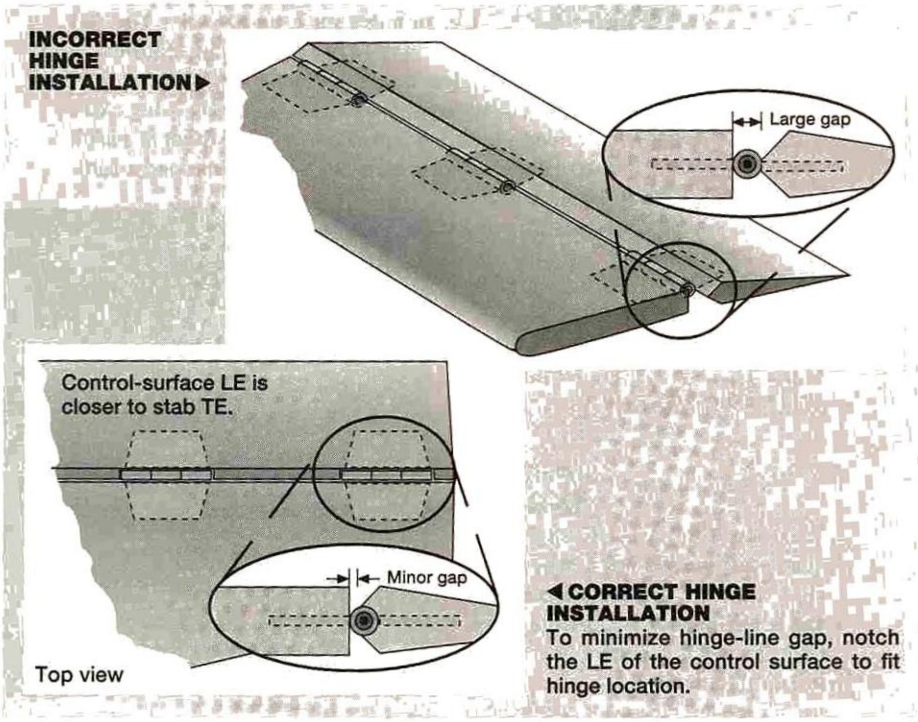
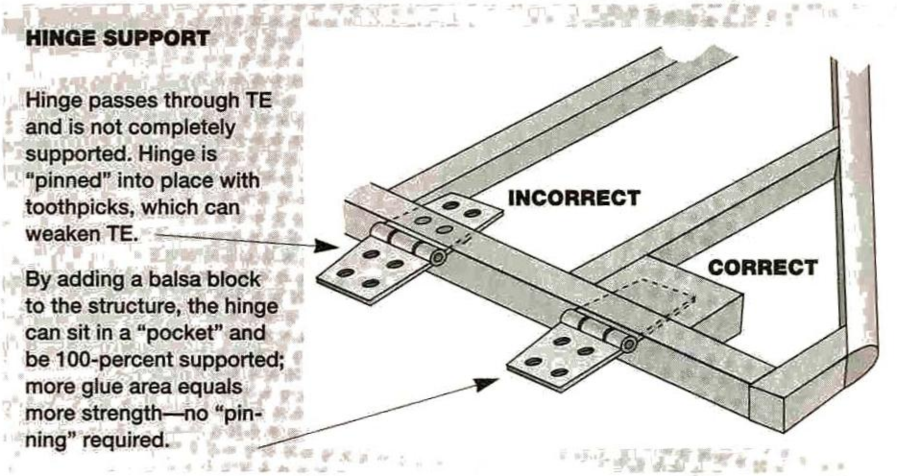
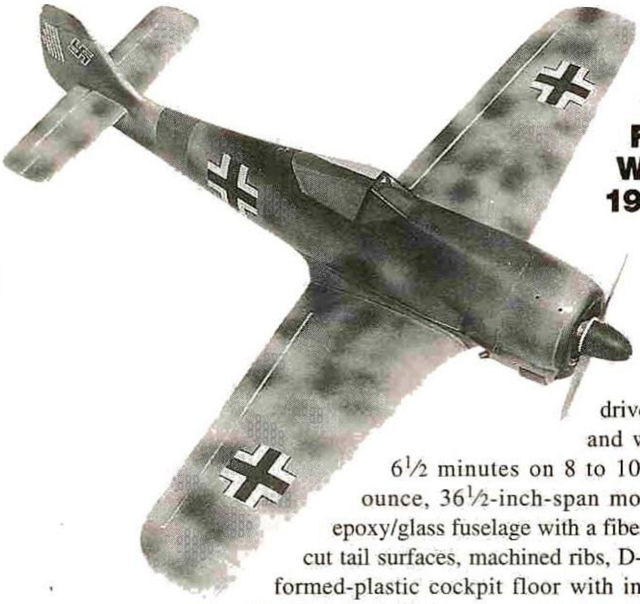






LATEST PRODUCT RELEASES



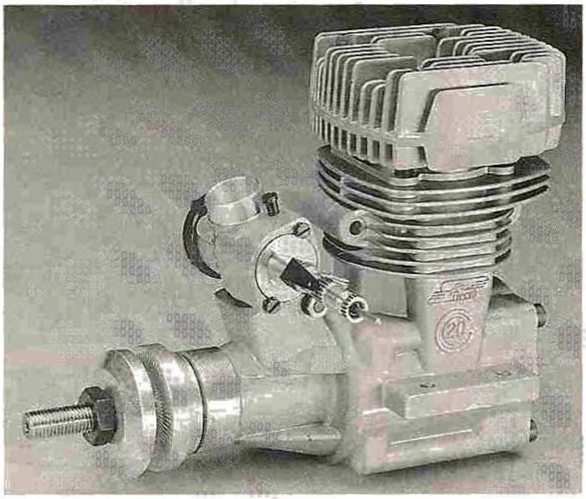
K&A MODELS UNLTD.

Focke Wulfe 190-A

This $^1\!/_{12}$-scale electric kit uses a 540 cam motor for power with a 2.3:1 belt drive and 10x8 prop and will fly for 6 to $6^1\!/_2$ minutes on 8 to 10 cells. The 45-ounce, $36^1\!/_2$-inch-span model features an epoxy/glass fuselage with a fiberglass cowl, pre-cut tail surfaces, machined ribs, D-tube wing, ABS formed-plastic cockpit floor with instrument panel, clear canopy, full-size plans with instructions and a hardware package with all connectors and pushrods needed for elevator and aileron installation.

Part no.—10127-E; **price**—$158.99 (plus $10.99 S&H).

K&A Models Unltd., 9300 Yvonne Marie Dr. NW, Albuquerque, NM 87114; (505) 890-7549.



SUPERTIGRE

G-2300

This new ringed, ABC engine for giant-scale models has a front intake, side exhaust, one-piece crankcase and a high-quality, two-needle carburetor for precise mixture control and instant throttle response. The muffler has a pressure tap and a positionable exhaust outlet. Specifications: displacement—1.41ci; bore—1.27 inch; stroke—1.10 inch; output—3.7b.hp at 12,600rpm; weight—3.77 pounds.

Part no.—SUPG0248; **price**—$359.99.

SuperTigre; distributed by Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.

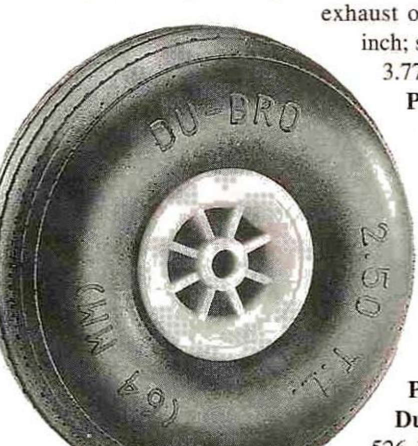
REID'S QUALITY MODEL PRODUCTS

Cheetah 25DX

This lightweight version of the Cheetah 25 has a lightweight mini flywheel and uses the CH Electronics ignition system. It comes with throttle linkage, a backplate engine mount and spacer, adjustable velocity stack, a scale Pitts-style muffler, chrome-plated cylinder bore and a 2-year warranty. The 25DX was designed for use with 10- to 15-pound models. Specifications: displacement—1.5ci; output—2.0hp+ at 6,800 to 7,500rpm; weight—3.5 pounds.

Price—$329.95.

Reid's Quality Model Products, 30 Clifton St., Phelps, NY 14532; (315) 548-3779; website: reidsmodels.com.



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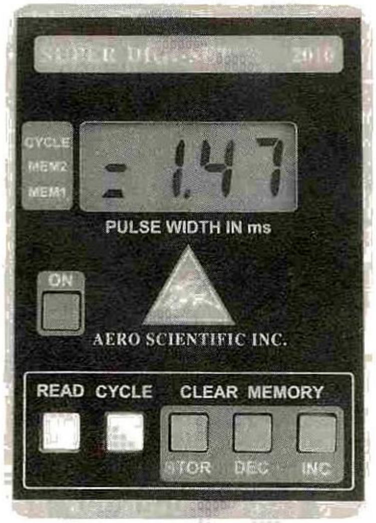
Prices—$4.99 to $10 per package.

Du-Bro Products Inc., P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604; email: rc@dubro.com; website: www.dubro.com.

Product NEWS



AERO SCIENTIFIC INC.

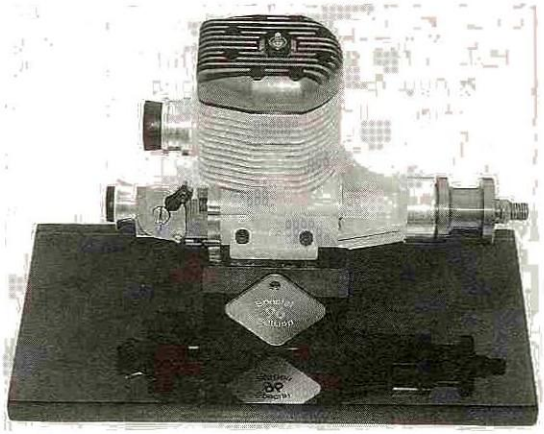
Super Digi-Set 2010

This highly accurate servo driver and receiver tester features an auto-cycle mode, programmable memory links, auto shutoff and output short-circuit protection. The quartz precision servo signal makes both servo setup and receiver measurements extremely accurate. Its large LCD displays servo drive pulse or receiver output pulse width with a resolution of 10 microseconds. Power is supplied by four AA batteries. **Price**—$129.95.

Aero Scientific Inc., P.O. Box 292, Grayslake, IL 60030; (847) 223-9066; fax (847) 223-9719.

BOB VIOLETT MODELS

.96 Special Edition



This upgraded engine has all the performance of the BVM .96 and also features a bored-out cylinder, larger but lightweight piston, longer wristpin, new head and combustion chamber design and a modified crankshaft counterbalance. It's designed to run on Wildcat 10- or 15-percent-nitro fuel and emits a very visible smoke trail.

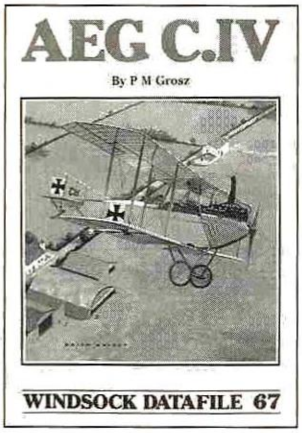
Bob Violett Models, 170 State Rd., Winter Springs, FL 32708; (407) 327-6333; fax (407) 327-5020; website: www.bvmjets.com.

MUD DUCK AVIATION

Agri-Duck

A low-wing version of the popular Mud Duck, this model has ailerons and a designer scale fuselage with the look of a working crop-duster. The high-lift wing has a D-tube leading edge for beam and torsional stiffness. The model requires only a single strut, so both assembly and flight rigging are easy and quick. **Prices**—$250 (kit), $125 (semi kit), $45 (full-size patterns).

Mud Duck Aviation, 7118 Westmoreland, Warrenton, VA 20187; (540) 347-1134.



ALBATROS PUBLICATIONS

Windsock Datafile Vol. 67

This volume covers a much-neglected modeling subject: the AEG C.IV. The same attributes that made it a stable bombing and reconnaissance aircraft would make it a great model subject. The Datafile contains 3-views, paint schemes and documentation photos, as well as a lot of historical data. **Price**—$16.95.

Albatros Publications Ltd.; distributed by Wise Owl Publications, 4314 W. 238th St., Torrance, CA 90505-4509; (310) 375-6258; email: wiseowl@sprintmail.com.

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1/7-scale Pilot Figure

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Part no.—TOPQ9000; **price**—$19.99.

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BUSINESS

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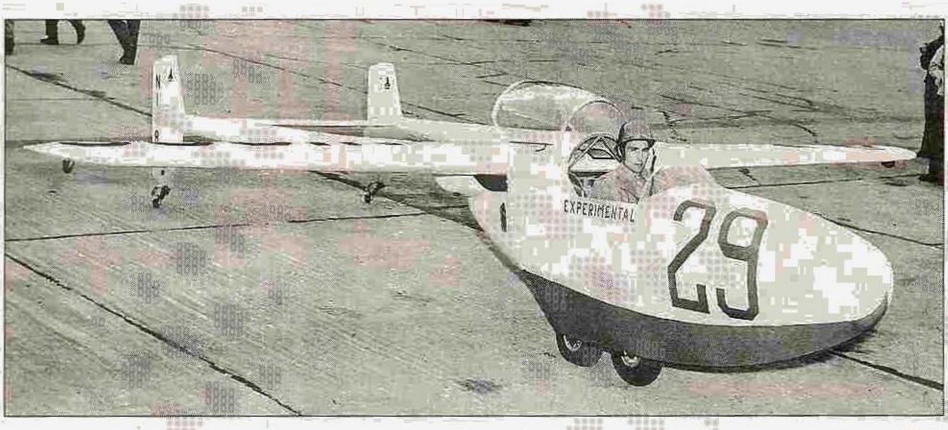
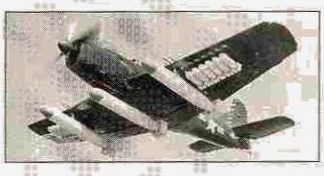


Boyd Wilcox of Roy, UT, is scratch-building a Martin AM-1 Mauler, so he readily identified it as the June '98 mystery plane. Designed as a single-seat attack bomber, only 149 Maulers were ever produced (they were replaced by Skyraiders). The plane in the foreground of the June '98 issue's photo was carrying a destructive payload of 10,689 pounds, including three 2,200-pound torpedoes, 12, 250-pound bombs and four 20mm aerial cannons with 800 rounds of ammunition. Known in the Navy as "Able Mabel," the Mauler had a range of 1,300 miles and used a Pratt & Whitney Wasp Major radial engine rated at 3,000hp.



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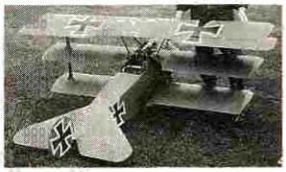

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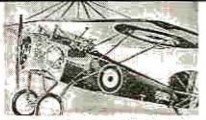

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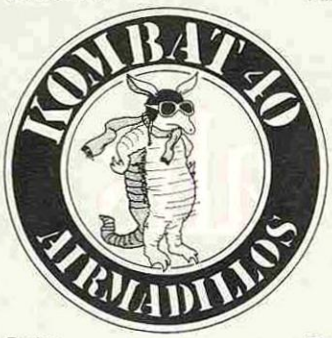

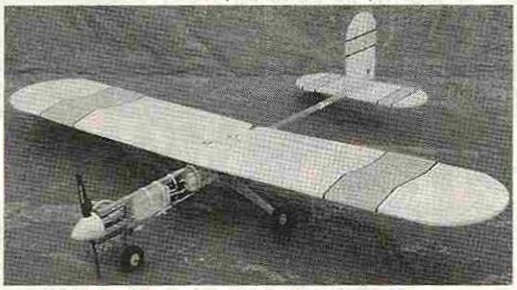

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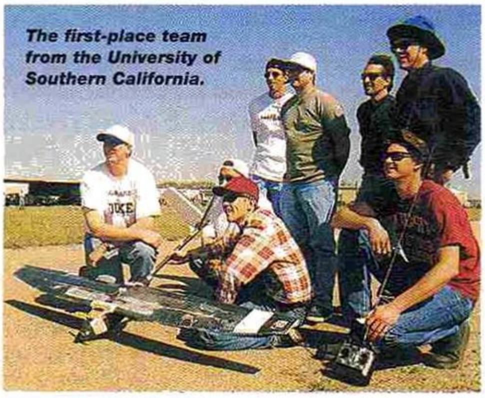
DESIGN, BUILD & FLY CONTEST

Seventeen university teams converged in Wichita, KS, in late April to compete in the second annual running of an extremely unusual competition for electric-powered R/C model aircraft. In the competition—sponsored by Cessna and the Office of Naval Research and organized by the American Institute of Aeronautics and Astronautics (AIAA)—each team designed model aircraft to meet challenging requirements. Unlike other classes of model aircraft competition, these aircraft had no restrictions on weight (other than the 55-pound AMA maximum), size, or the number or power rating of the electric motors. Each aircraft was limited to a $2^1/_2$-pound Ni-Cd propulsion battery pack and was required to fly with a $7^1/_2$-pound steel payload.



The first-place team from the University of Southern California.

The flight requirements were to take off from a 300-foot runway, demonstrate control by completing a horizontal figure-8, then complete as many laps as possible in 7 minutes between two pylons spaced 700 feet apart. Each aircraft then had to successfully land on the runway. The teams were scored on their flights as well as on their detailed design reports that documented the design and construction processes.

Faced with these constraints, the teams conducted sophisticated tradeoffs between aircraft size, aerodynamic parameters, structures and propulsion systems, and there was a wide variety of aircraft designs in competition. Interestingly enough, flying-wing designs were entered by Washington State University, UCLA, the University of Texas and last year's overall winner, the University of Illinois. The most sophisticated design was Washington State's 110-inch-span entry. The wing surfaces were molded carbon-fiber shells formed over CNC-machined metal master molds, with all the electronic equipment as well as the steel payload packaged internally and covered by removable epoxy-glass skin panels.

The most successful of the flying-wing entries was the University of Texas' Longhorn Lightning, which made several successful flights during the day. Using a relatively uncomplicated construction technique of carbon fiber and epoxy/glass over white foam, the UT entry spanned 115 inches and used a geared MaxCim motor to achieve impressive takeoffs as well as smooth flight in the turbulent flying conditions.

This year's overall winner was the team from the University of Southern California whose V-tail, all-composite machine flew the course at high speed as if on rails. USC's carbon-fiber machine cruised the course extremely smoothly and completed flawless pylon turns under the capable piloting of Wyatt Sadler, a test pilot of sophisticated Unmanned Aerial Vehicles at AeroEnvironment (see the August '97 "Final Approach"). With a relatively small wing area, the USC plane used full trailing-edge cambering (coupled flaps and ailerons) to increase wing lift for takeoffs and landings. The powerplant used was Aveox's Pattern 40 brushless motor turning an APC 9x6 propeller on direct drive.

Left: the team from San Diego State entered this canard pusher model powered by a geared Astro Cobalt 40.

Texas A&M took second place with an attractive design spanning 100 inches and built using conventional modeling materials: balsa, spruce and iron-on plastic covering. A&M's design approach was an efficient aerodynamic design that flew the course at moderate airspeeds using a geared Aveox motor and a Graupner folding carbon-fiber propeller. Their pilot, Rip Rippey, has been flying R/C airplanes and helicopters for about 10 years and was also the team leader. A&M's high-placing entry was proof that a well-designed aircraft in the hands of a skillful pilot can be extremely competitive against more complicated and sophisticated machines.

The extreme variety of aircraft designs entered and the good performances turned in by many were refreshing to see, as was the sound engineering demonstrated by all the students. The AIAA, Cessna and the Office of Naval Research should be commended for providing this real-world opportunity for students to design and build an aeronautical vehicle to meet challenging design and flight objectives. Next year's competition will be held in Maryland, and the advance word is that the rules may be significantly modified to encourage more innovation. For more information on this year's contest results as well as the rules for next year's competition, check the AIAA's Web page at http://amber.aae.uiuc.edu/~aiaadbf.

University of Texas Longhorn Lightning at the takeoff line.

—Pete Young